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Kojima et al.

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(54) **ROAD INDICATION DEVICE**

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(30) **Foreign Application Priority Data**

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Jun. 17, 2003 (JP) 2003-172358
Sep. 29, 2003 (JP) 2003-338315
Jan. 22, 2004 (JP) 2004-014644

(51) **Int. Cl.**
B60Q 1/26 (2006.01)
F21V 7/00 (2006.01)
F21S 8/00 (2006.01)

(52) **U.S. Cl.** **362/540**; 362/296; 362/431

(58) **Field of Classification Search** 362/296, 362/299, 335, 410, 431, 102
See application file for complete search history.

(56) **References Cited**

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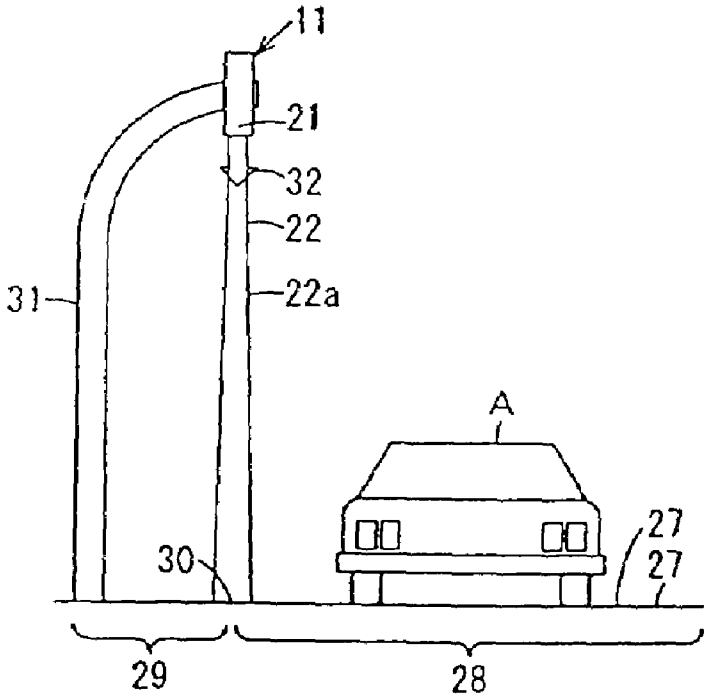
(74) *Attorney, Agent, or Firm*—J.C. Patents

(57) **ABSTRACT**

A road indication device is provided. The road-guidance indicating device has a light projection unit including light control means for controlling a lamp and light emitted from the lamp. The light projection unit project a light whose peak luminosity is 30000 cd or more, i.e., the light has a luminosity equal to or larger than a peak luminosity of a headlight of a car running on the road. Since a light pillar of light having a high light output and a thick light pillar is projected from the light projection unit, the visuality of the light pillar is improved even in the bad weather and the boundary between the driveway and the shoulder on the road can be affirmatively guided and indicated.

8 Claims, 15 Drawing Sheets



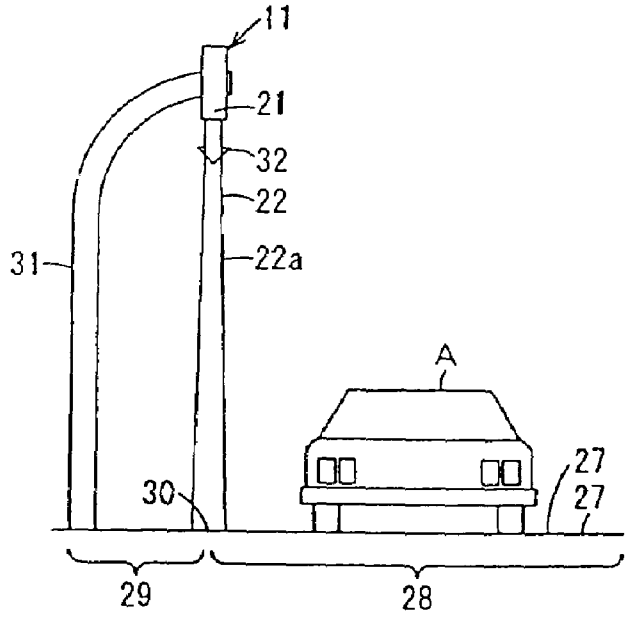

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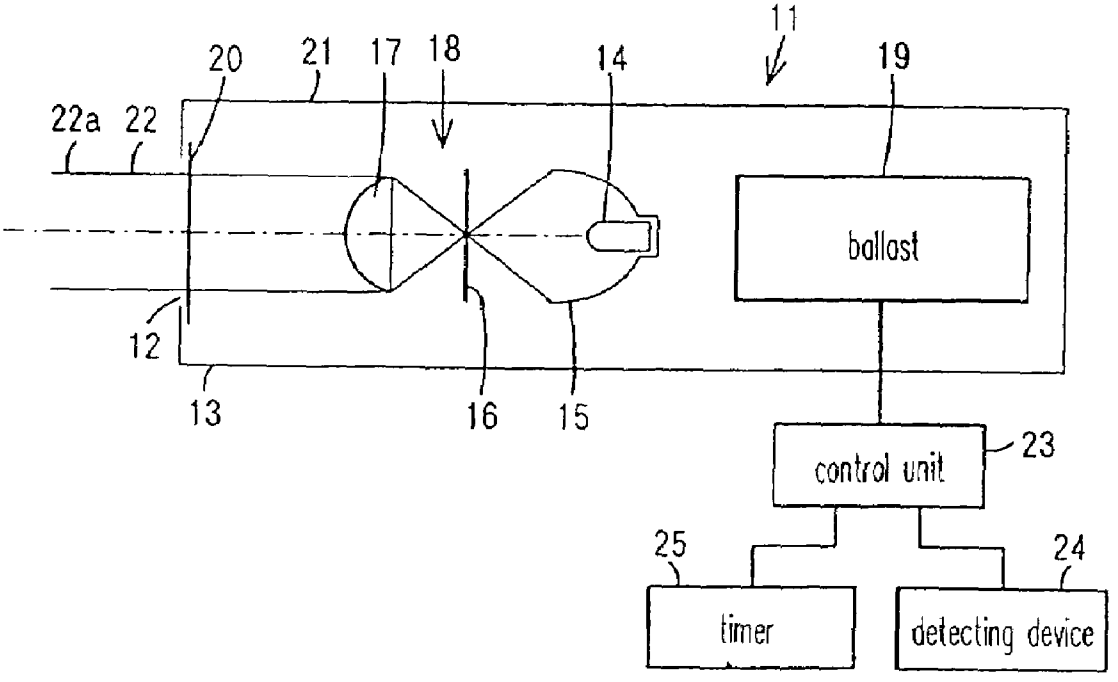
FIG. 1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ballast
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control unit
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timer
detecting device

FIG. 2

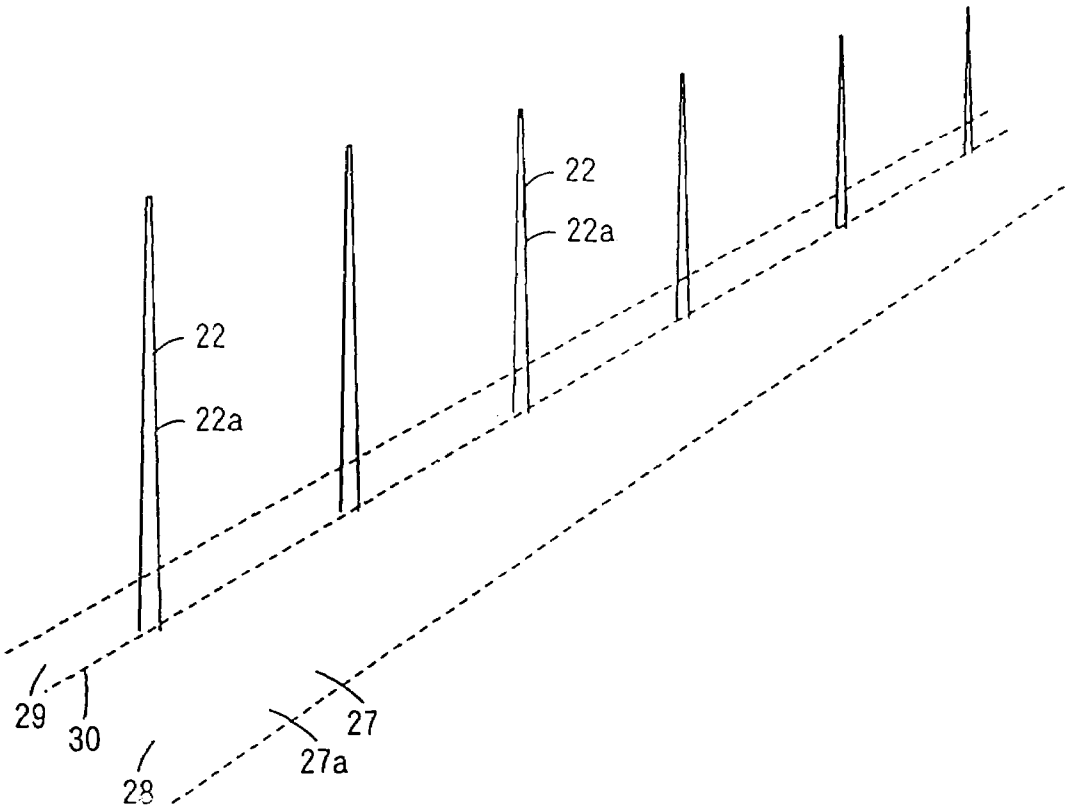
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FIG. 3

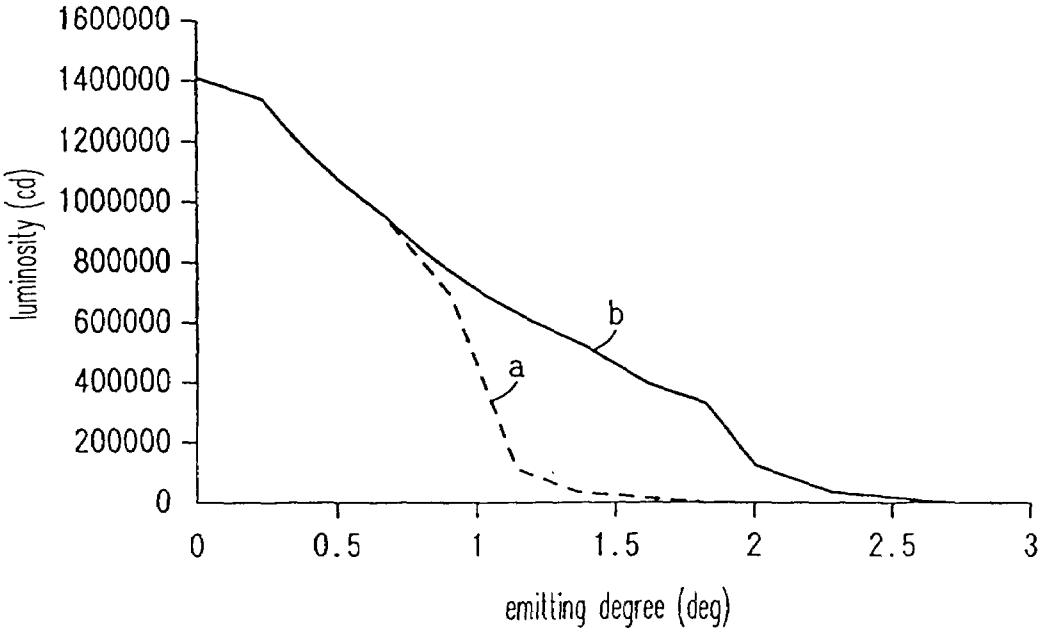

1600000
1400000
1200000
1000000
800000
600000
400000
200000
0
luminosity (cd)
0
0.5
1
1.5
2
2.5
3
emitting degree (deg)
b
a

FIG. 4

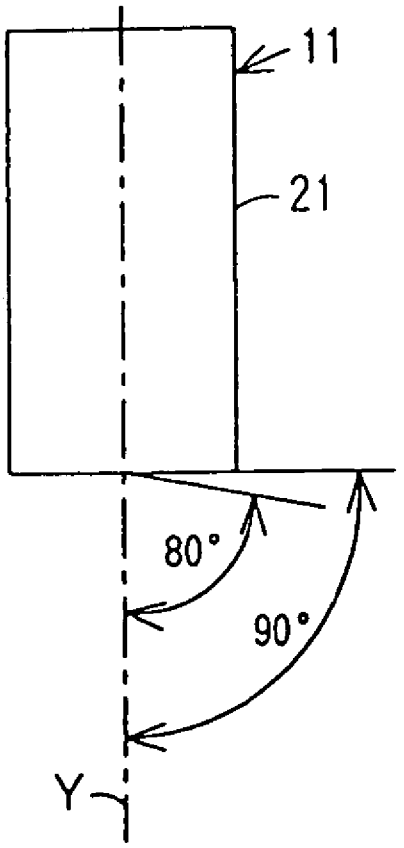
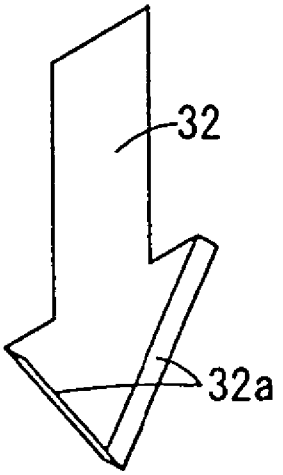


FIG. 5



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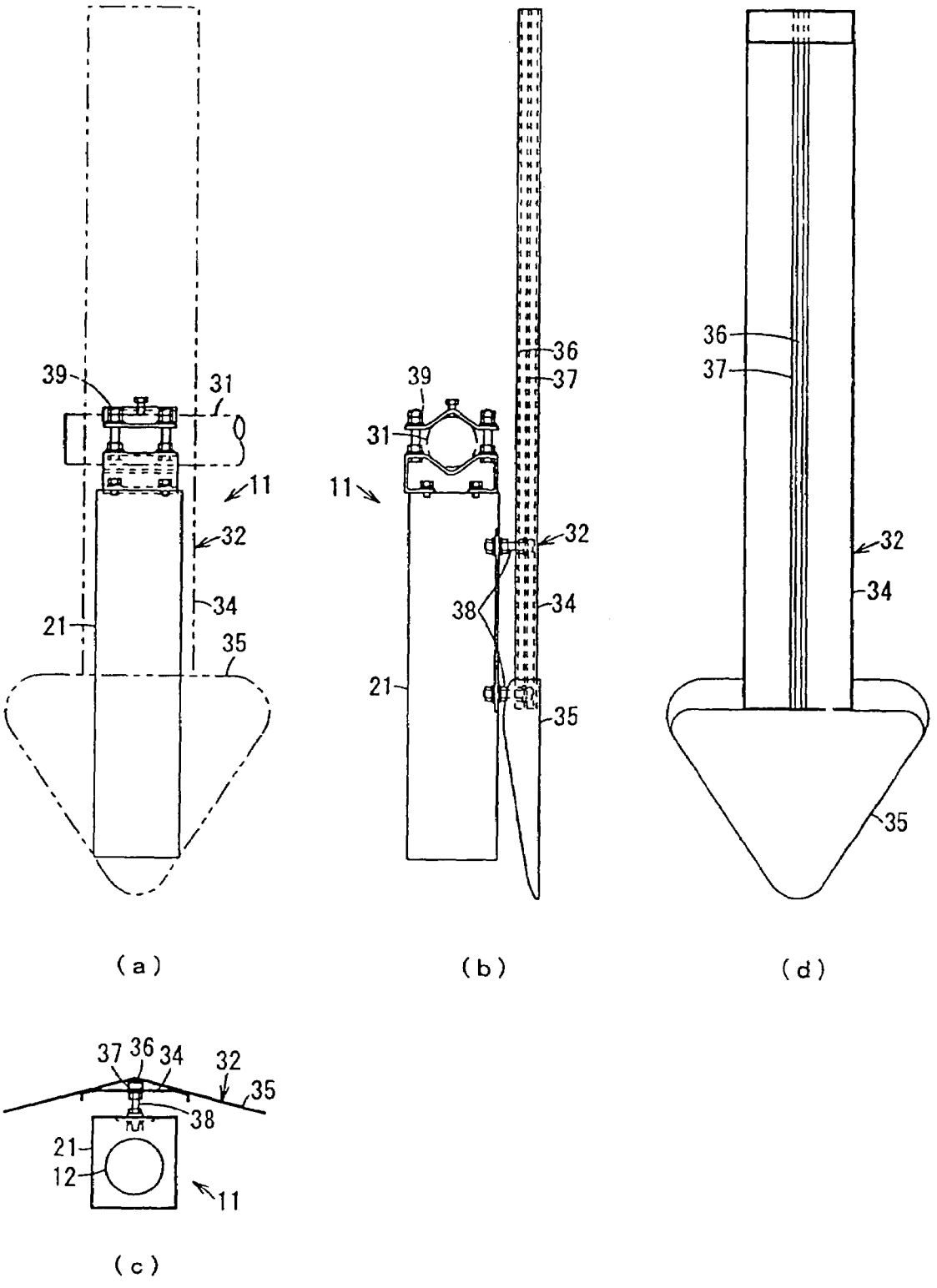
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(a)
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(b)
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(d)
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11
(c)

FIG. 7

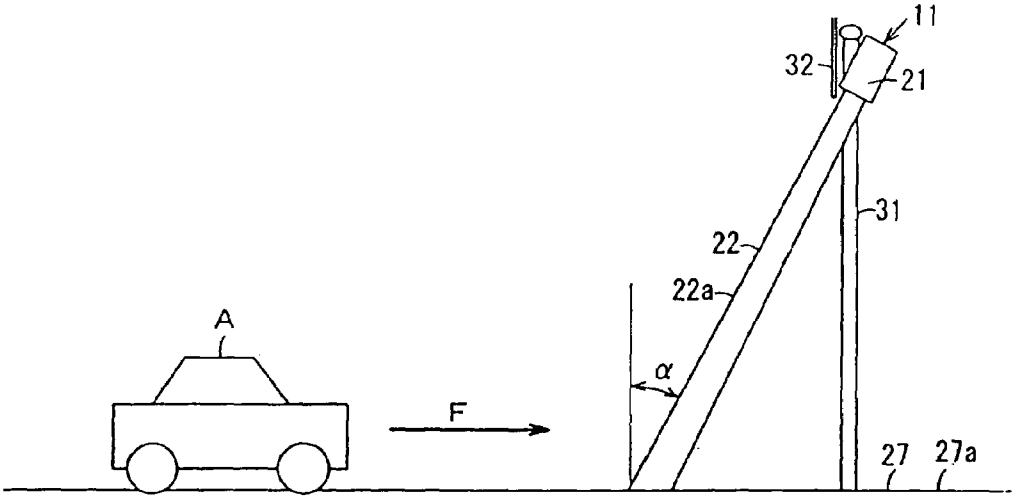
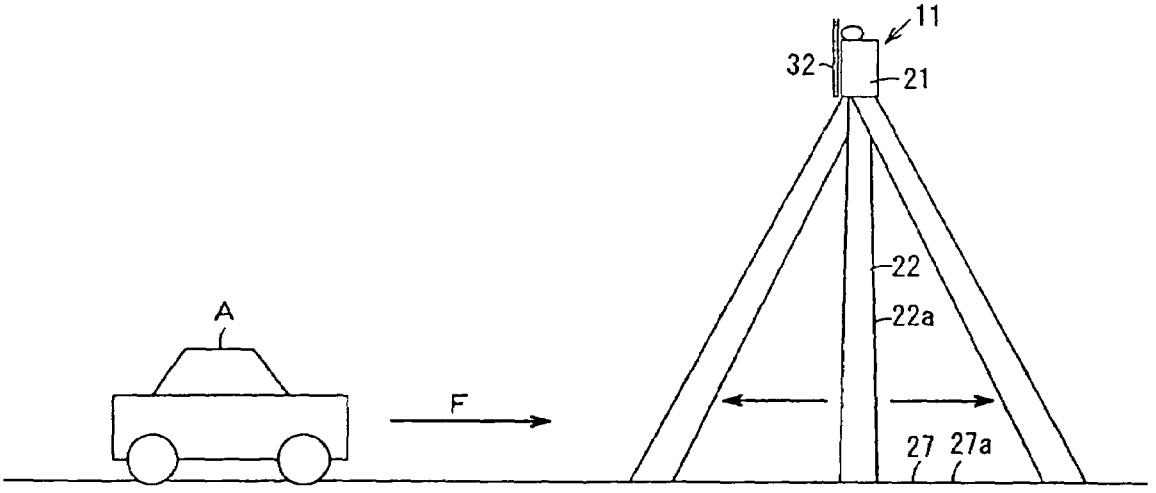


FIG. 8



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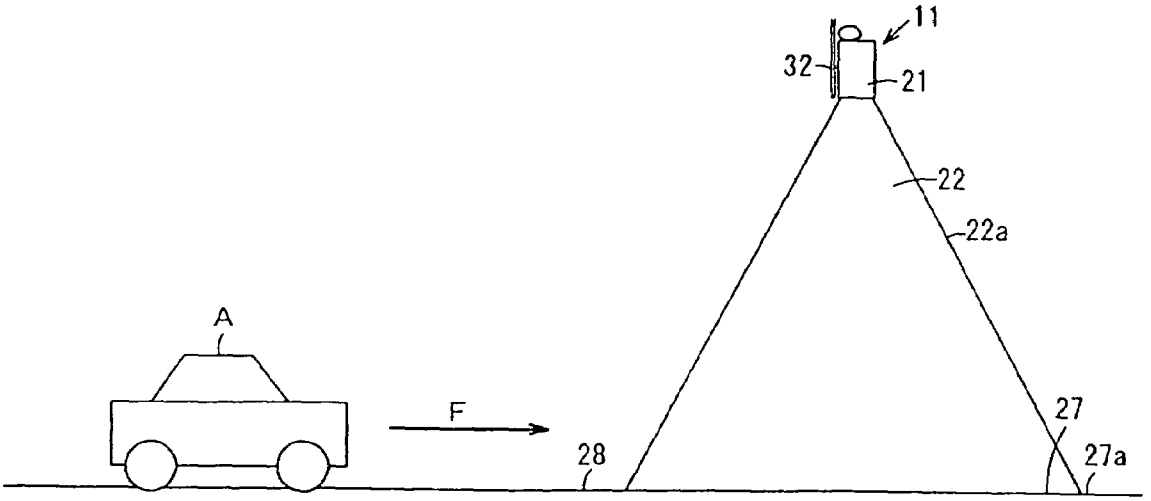
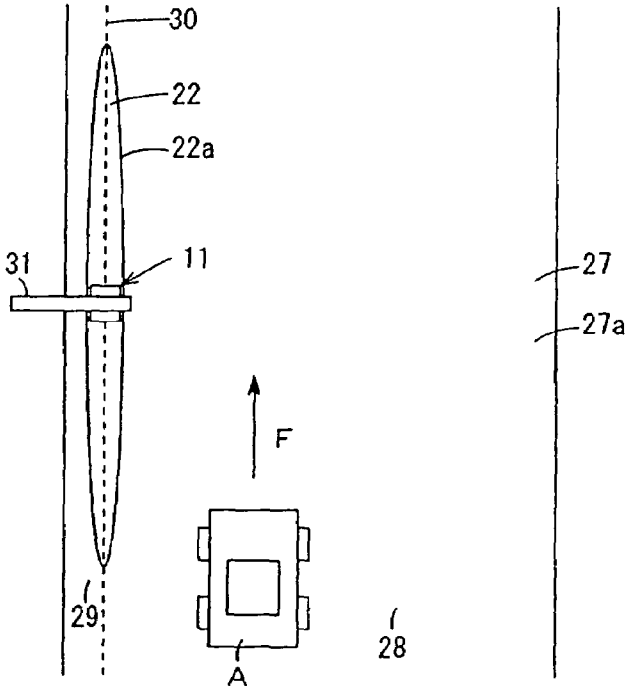


FIG. 10



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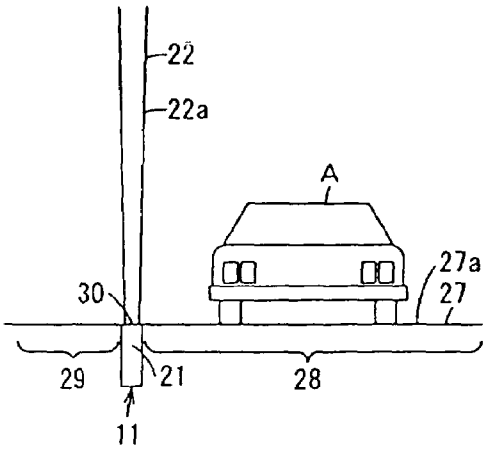

FIG. 12

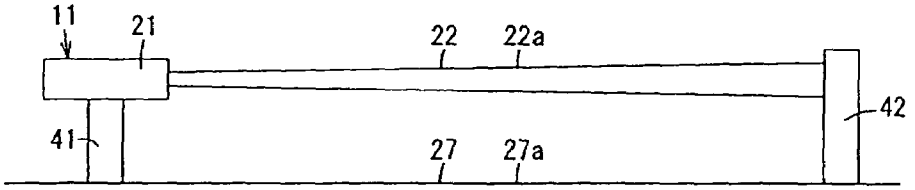

FIG. 13

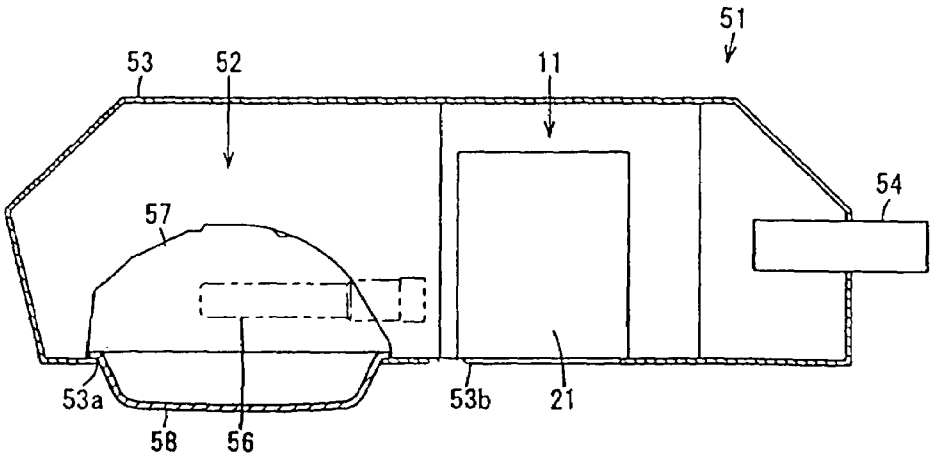

FIG. 14

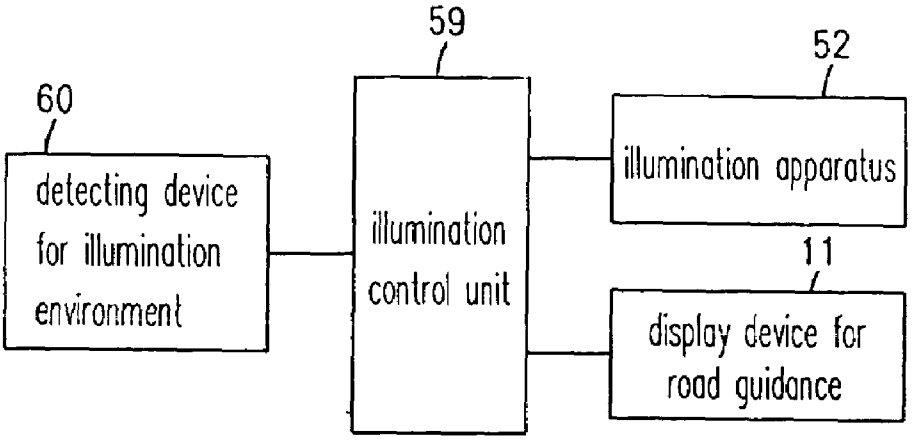
59
52
60
detecting device for illumination environment
illumination control unit
illumination apparatus
11
display device for road guidance

FIG. 15

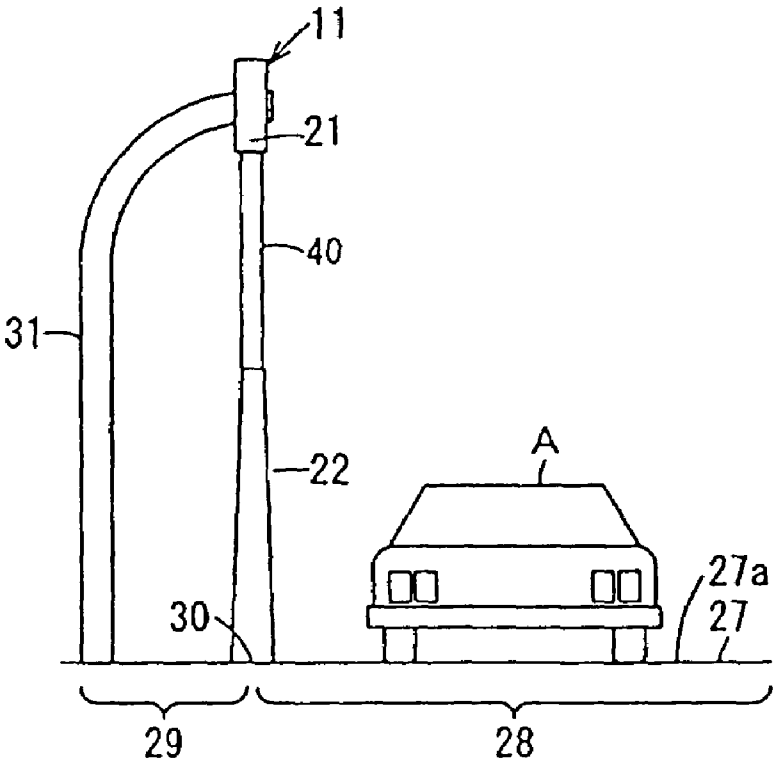
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FIG. 16

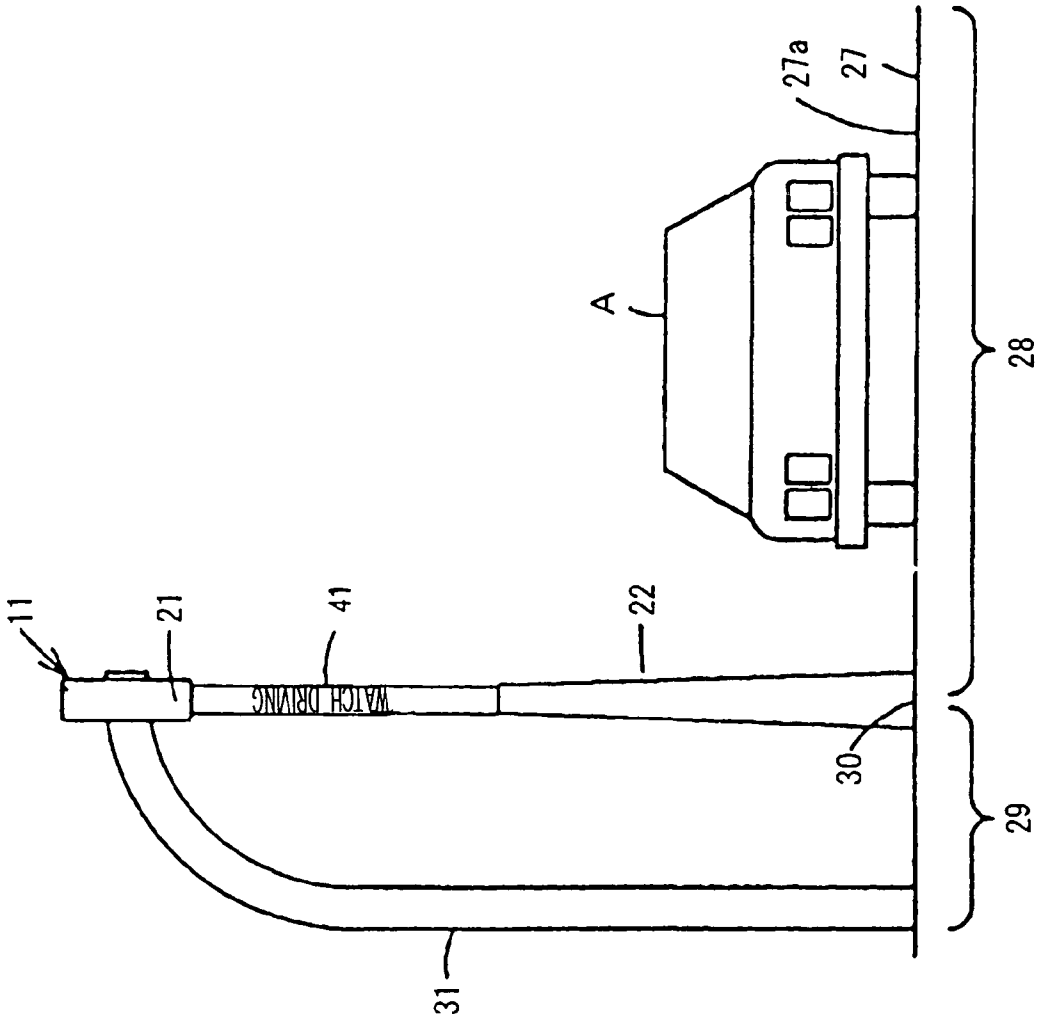
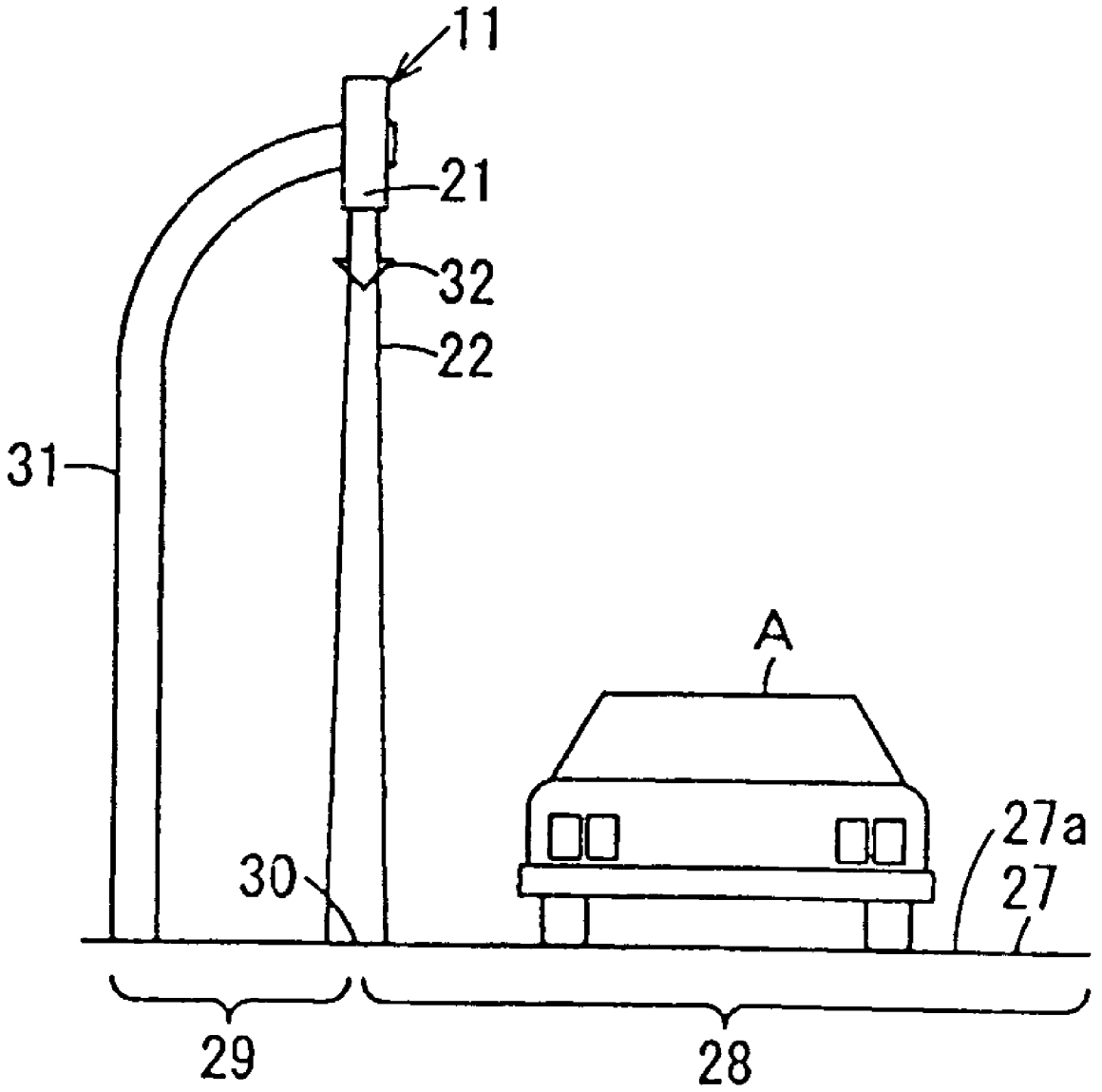


FIG. 17



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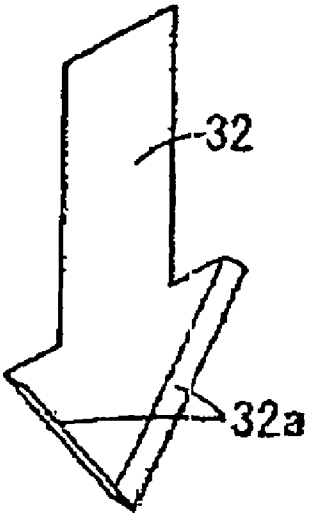

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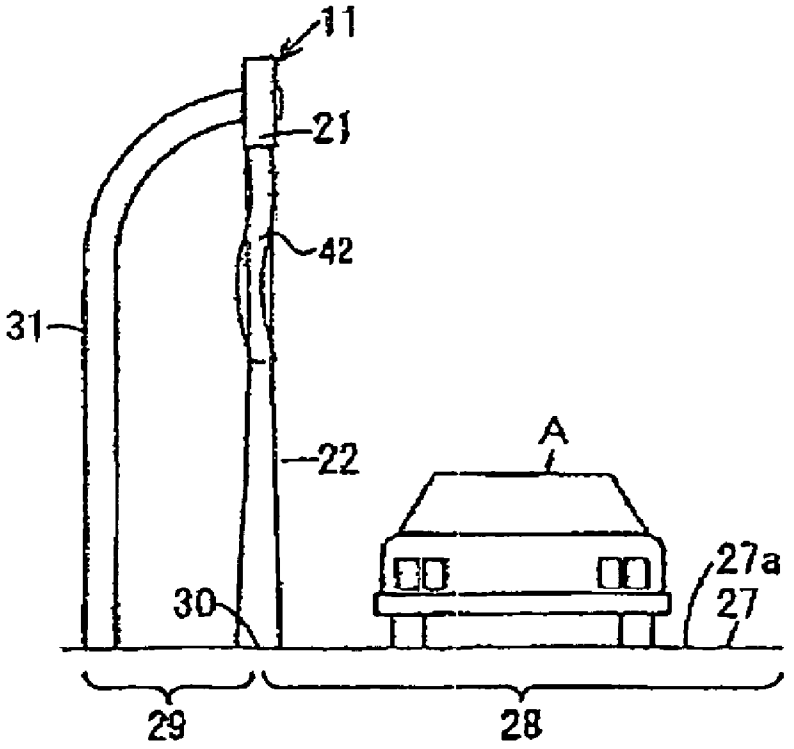

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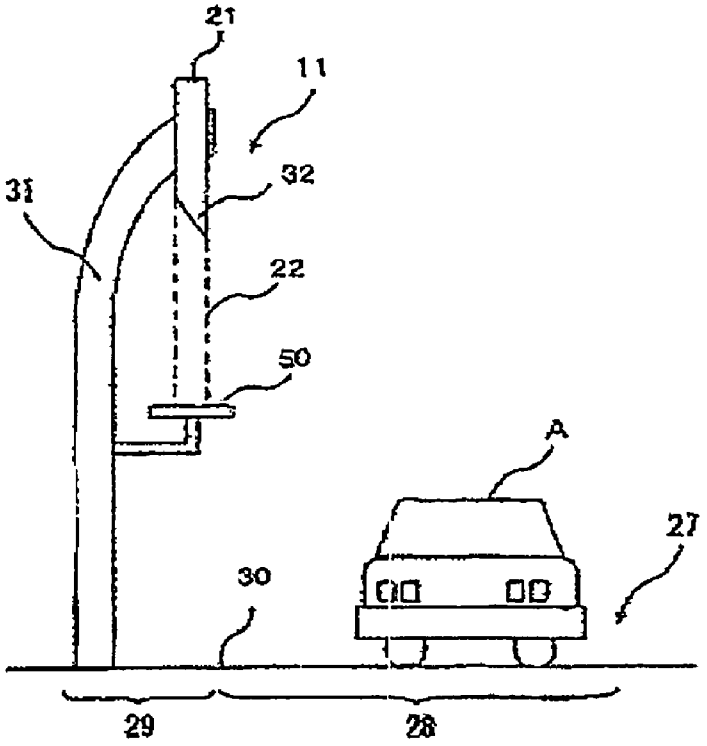


FIG. 21

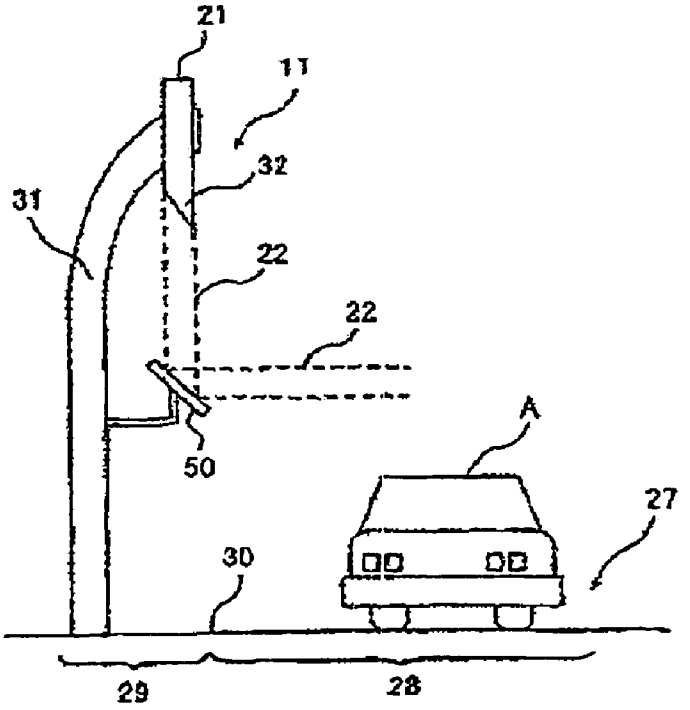
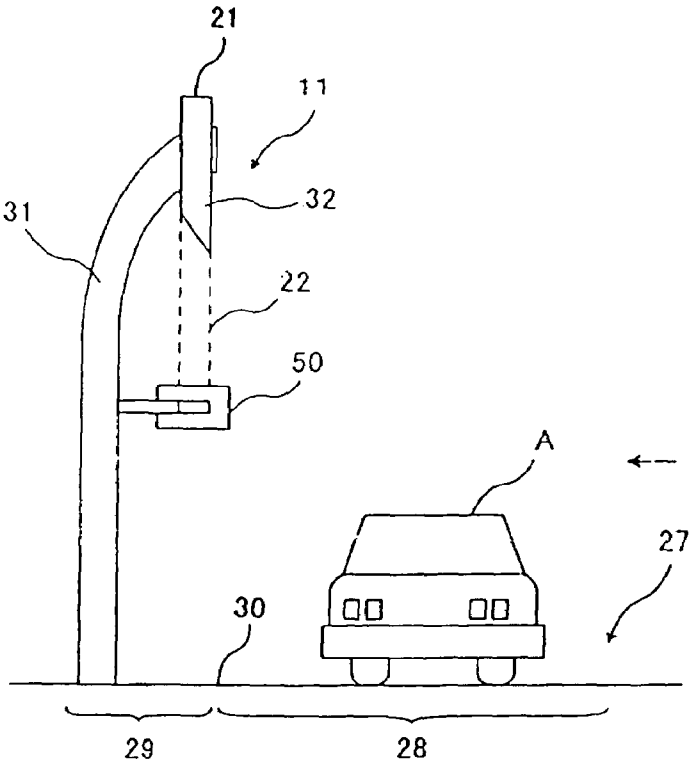


FIG. 22



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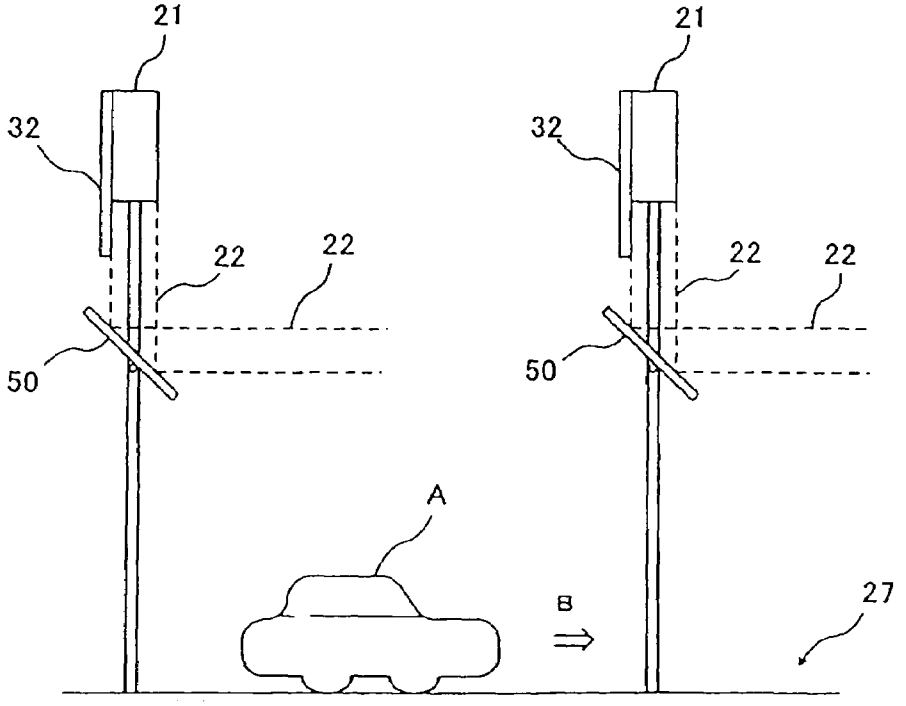


FIG. 24

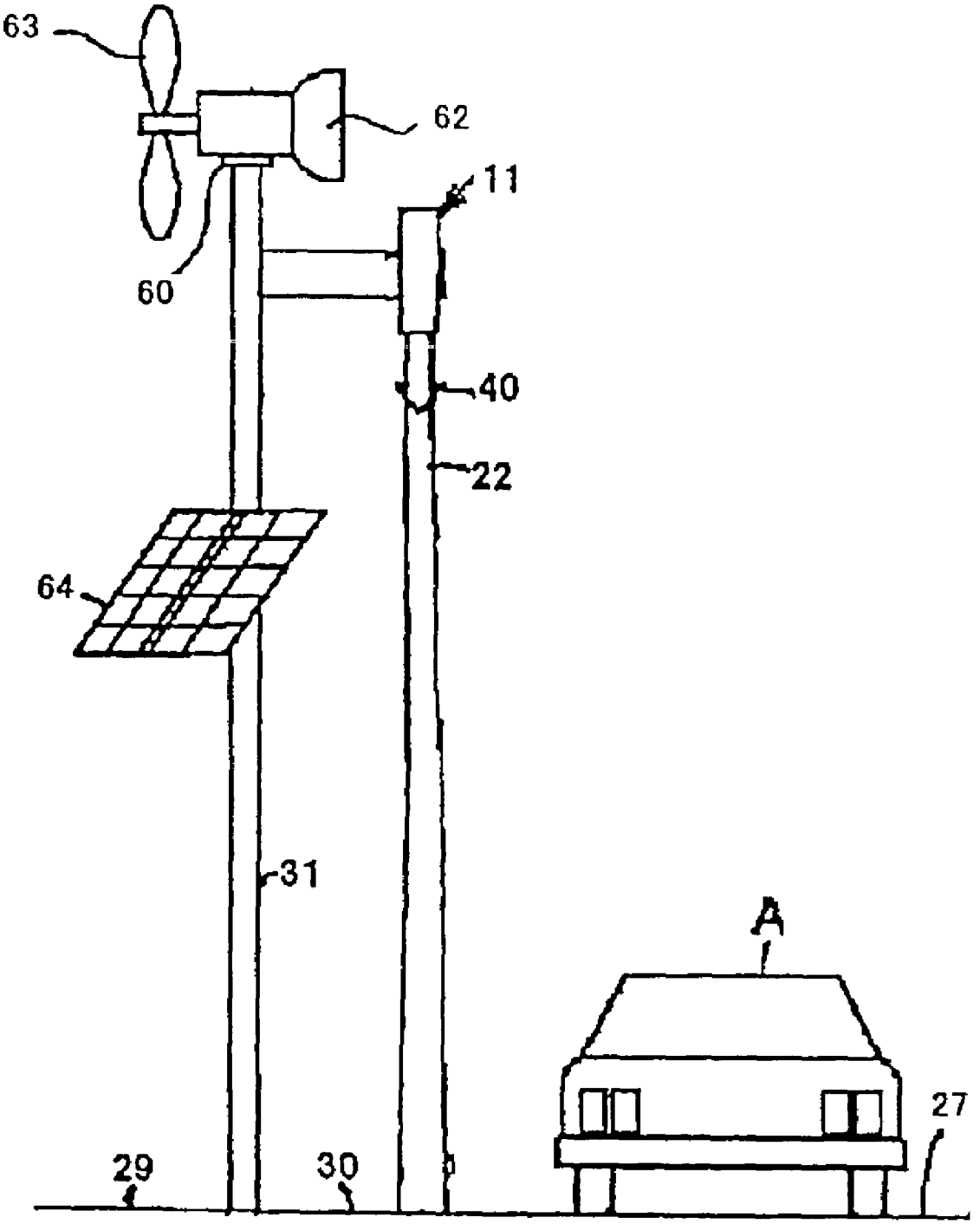
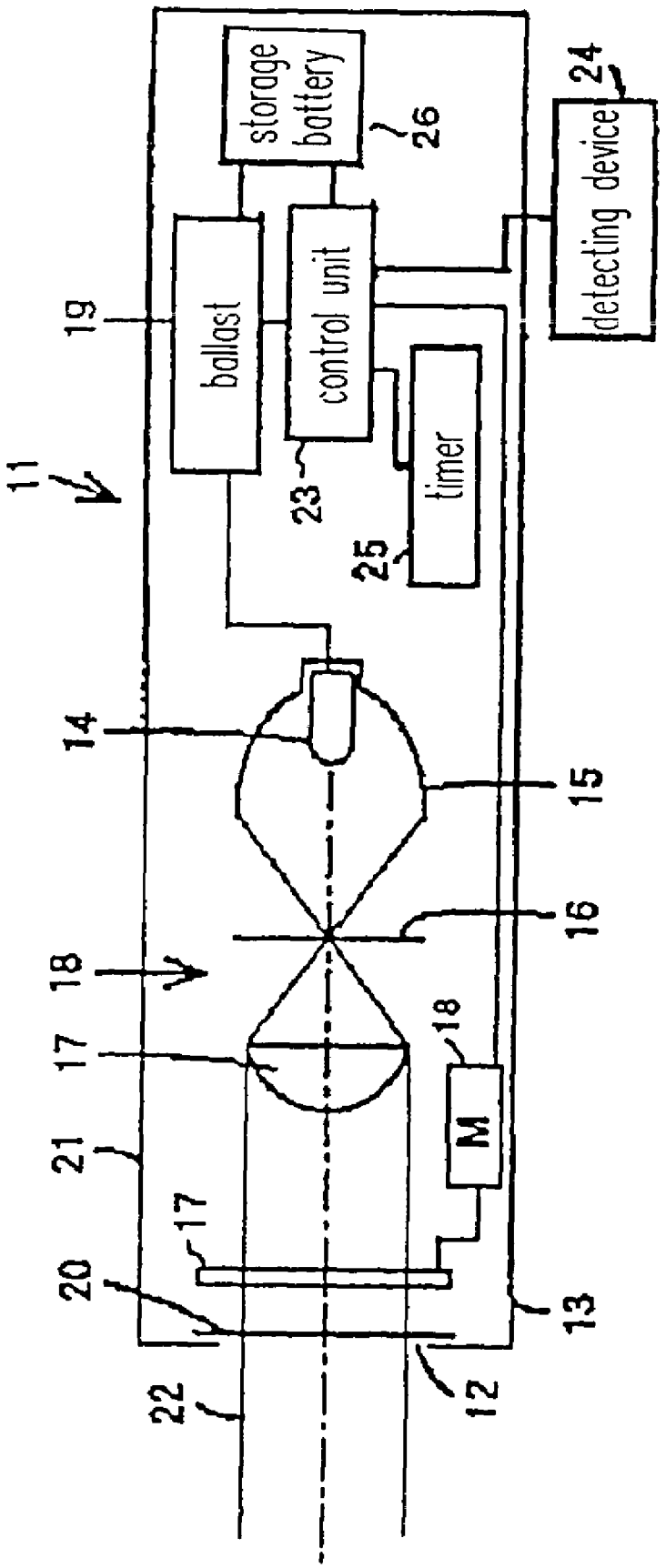


FIG. 25


storage battery
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detecting device
ballast
control unit
timer
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FIG. 26

ROAD INDICATION DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Japanese application serial no. 2003-142006, 2003-170710, 2003-172358, 2003-338315 & 2004-014644, respectively filed on May 20, 2003, Jun. 16, 2003, Jun. 17, 2003, Sep. 29, 2003 & Jan. 22, 2004.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to a road indication device for guiding and indicating positions on the road by light.

2. Description of Related Art

Generally, the road lamps for illuminating the road are lit according to the surrounding brightness to illuminate a predetermined range of the road. However, when the weather is bad such as snowfall, etc., the snow under the covered area of the road lamp is irradiated to create a light curtain, so that disability glare might occur.

In addition, at snowbound area, when the boundary between the road and the shoulder is buried by the fallen snow, the boundary might not be distinct. Therefore, arrow signs are used to indicate the boundary of the road for warning the drivers. In this way, a driver who drives a car can be made aware of the boundary of the road by the arrow signs arranged at a predetermined distance along the road while driving the car. However, when the weather is bad such as snowstorm, the visbility of the arrow sign is decreased, sufficient guiding indication is impossible.

Japanese Laid Open No. 2002-201617 (FIGS. **1**–**2**, pages 2–3) discloses a method of setting the arrow sign and a laser irradiation device together. The leaser beam from the laser irradiation device is adapted for irradiating the boundary of the road. Since the laser beam irradiates the snow, the irradiated portion from the laser irradiation device to the road can be seen as a single light ray to guide and indicate the boundary of the road.

However, at least the inventor of the present invention does not know that using such laser beam to perform the guidance and indication during the bad weather such as the snowfall has not been implemented in practice. According to the study conducted by the inventor of the present invention, irradiating the laser beam from the laser irradiation device to the boundary of the road cannot obtain sufficient visibility in the bad weather such as the snowstorm because the light output of the laser beam is small and the laser beam is thin. In addition, the color of the laser beam is restricted and a suitable color for better visibility cannot be selected. Therefore, there is a problem that the degree of freedom of selecting the light color is small.

To obtain a light with sufficient visibility in the bad weather, such as, the snowfall using the laser beam, a huge laser device is required and therefore expensive. Therefore, it is very difficult to set the laser device providing sufficient light together with the arrow sign on the road. In addition, because the laser irradiation device is set outdoors, people might gaze the laser irradiation device and thereby adversely affecting human eyes.

SUMMARY OF THE INVENTION

According to the foregoing description, an object of this invention is to provide a road indication device and an irradiation device capable of improving the visibility in the bad weather for precisely guiding and indicating the position of the road.

In order to achieve the object mentioned above, the present invention provides a road indication device. The road indication device comprises a light projection unit having a lamp and an optical device, for projecting a light of the lamp to a road, wherein a peak luminosity of the light is equal to or larger than 30000 cd.

According to the above embodiment of the present invention, the light of the lamp is condensed onto the road by a lens and a reflection mirror serving as light control means, and an opening. Alternatively, by using a lamp having large light beam, a light with a peak luminosity of 30000 cd or more is projected from the light projection unit. Namely, by projecting a light with a peak luminosity equal to or larger than the peak luminosity of the headlight of the car running on the road, the light output can be easily large and a thick light pillar can be formed. Furthermore, since the degree of freedom for selecting the color of the light is large, the visibility of the light pillar in the bad weather can be accordingly improved. In addition, a high brightness discharge lamp, a halogen bulb, etc. can be used as the lamp, and therefore, the road indication device can be inexpensive and compact compared with the conventional laser irradiation device.

In the above road-guidance indicating device, a ½-beam angle of the light projected from the light projection unit is equal to or less than 1°, and a 1/10-beam angle of the light projected from the light projection unit is equal to or less than 2°. The ½- or 1/10-beam angle is defined as the angle enclosed by two lines which intersect the candlepower distribution curve at the points where the candlepower is equal to ½ or 1/10 of its maximum (See the definition of "beam spread" in page 3–10 of the *IES Lighting Handbook,* 3rd Edition, published by the Illuminating Engineering Society, 1860 Broadway, New York 23, N.Y., 1959).

In the present embodiment, by setting the ½-beam angle of the light projected from the light projection unit equal to or less than 1° and the 1/10-beam angle of the light projected from the light projection unit equal to or less than 2°, the light pillar can be clearly identified and the visibility can be improved.

Furthermore, a shortest length of an irradiation surface of the 1/10-beam angle of the light projected from the light projection unit is larger than or equal to 50 mm and less than or equal to 300 mm.

In the present embodiment of the present invention, the size of the cross section of the light projected from the light projection unit is set to the size of the 1/10-beam angle at the irradiation surface. The shortest length of the 1/10-beam angle is set to a diameter of a circular irradiation surface, a short side of a rectangular irradiation surface, or a minor axis of an elliptical irradiation surface.

If the shortest length is less than 50 mm, the cross section of the light is too thin, and the visibility in the bad weather becomes difficult. In addition, if the shortest length exceeds 300 mm, the power of the lamp will increase and the device volume will also increase, which is not very economic. Furthermore, by setting the shortest length to 100 mm to 300 mm, preferably 200 mm to 300 mm, a good visbility can be obtained.

A luminosity at 90 degrees with respect to a vertical direction of the light projected from the light projection unit is equal to or less than 10 cd per lamp beam 1000 lm, and a luminosity at 80 degrees with respect to the vertical direction is equal to or less than 30 cd per lamp beam 1000 lm.

In the present embodiment of the present invention, since the luminosity at 90 degrees with respect to a vertical direction of the light projected from the light projection unit is equal to or less than 10 cd per lamp beam 1000 lm, and the luminosity at 80 degrees with respect to the vertical direction is equal to or less than 30 cd per lamp beam 1000 lm, the occurrence of glare to the driver of the car running on the road can be suppressed.

The present invention further provides a road indication device. The road indication device comprises a light projection unit arranged above a boundary of a carrigeway, for projecting a light towards the carrigeway, wherein a peak luminosity of the light is equal to or larger than 30000 cd; and a light guiding device arranged at a light projection side of the light projection unit.

The light projection unit comprises a light source, and is capable of projecting light from a location above the road boundary toward the carrigeway. The light projection unit further comprises a reflection mirror, an opening and a lens, etc. for effectively irradiating the light emitted from the light source towards the carrigeway. If the irradiated light has a peak luminosity of about 30000 cd or more, the ½-beam angle of the light projected from the light projection unit is 1° or less and the 1/10-beam angle of the light projected from the light projection unit is 2° or less, the visibility for the driver can be improved in the bad weather. In addition, all types of light source, such as, a high pressure discharge lamp or a halogen lamp can be used as the light source of the present invention. However, point light source or the like can effectively irradiate the light. The road boundary is near a boundary between the driveway and the shoulder of the road.

The light guiding device utilizes a total reflection caused by a difference of refractive index between the air and material, and to the light is effectively guided to the target area. The optical fiber in the optical communication field and optical waveguide, etc. can be used as the light guiding device.

In this way, since the light irradiated from the light projection unit can be guided to the target area by the light guiding device, the light beam can be irradiated with an acute angle. In addition, if the light is also output from the side face of the light guiding device, the light guiding device glows together with the light beam, and therefore, the road boundary can be easily recognized. Furthermore, if an indication of such as "WATCH WHILE DRIVING" can be formed on the side face of the light guiding device in order to alert the driver.

The present invention further provides a road indication device. The road indication device comprises a light projection unit arranged above a boundary of a carrigeway, for projecting a light towards the carrigeway, wherein a peak luminosity of the light is equal to or larger than 30000 cd; and a reflection member arranged at a light projection side of the light projection unit.

In one embodiment of the present invention, the road indication device further comprises an arrow sign formed on the light projection unit.

The arrow sign can be set together with the light projection unit. In addition, a portion or all of the arrow sign can be formed by a light guiding material or a reflection material. The light projection unit can irradiate either a portion or all of the arrow sign. When the light projection unit irradiates the arrow sign, a strong light like a light beam can be irradiated in the snowstorm. According to an embodiment of the present invention, the brightness can be adjusted in a manner to only irradiate the arrow sign.

According to an embodiment of the present invention, both of the light beam and the arrow sign can glow, and therefore, the driver can easily identify the road boundary.

The present invention further provides a road indication device. The road indication device comprises a light projection unit arranged above a boundary of a carrigeway, for projecting a light towards the carrigeway; and a light control member arranged between the light projection unit and the carrigeway to prevent the light irradiated from the light projection unit to the carrigeway from reaching the carrigeway.

A light source is installed within the light projection unit and the light projection unit is capable of projecting light from a location above the road boundary toward the carrigeway. A reflection mirror, an opening and a lens, etc. are further installed within the light projection unit for effectively irradiating the light emitted from the light source towards the carrigeway. All kinds of light sources, such as, a high pressure discharge lamp or a halogen lamp, can be used as the light source of the light projection unit according to an embodiment of the present invention. However, point light source or the like can effectively irradiate the light. The road boundary is near a boundary between the driveway and the shoulder of the road.

The light control member is adapted for preventing the projection of the incident light directly from the light projection unit and the reflected light from reaching the carrigeway. The surface of the light control member where the light from the light projection unit is irradiated thereon can be a mirror surface for reflecting the light or a light shielding surface for absorbing the light.

The surface of the light control member where the light from the light projection unit is irradiated thereon can be formed with a color to serve as the light shielding surface to absorb the light. Black color or a color near to black color can be used as the color for absorbing the light. In this case, since the light from the light projection unit is shielded by the light control member, the leaked light reflected by the light control member can be properly prevented from reaching the carrigeway, and the occurrence of such as discomfort glare and disability glare due to the reflection light from the light control member can be effectively reduced.

According to an embodiment of the present invention, since the light from the light projection unit can be prevented from reaching the carrigeway by using the light control member, the occurrence of discomfort glare and disability glare, etc. can be effectively reduced when gazing the light projection unit from below.

In one embodiment of the above road indication device, a surface of the light control member facing the light projection unit is formed by a mirror surface for reflecting the light.

In the present embodiment of the present invention, the surface where the light from the light projection unit is irradiated thereon is formed with the mirror surface for reflecting the light towards the light projection unit side. In this case, a multicoated film or a filter for determining the color of the reflected light can be formed on the mirror surface of the light control member. In this way, since a color can be added to the light reflected by the light control member, the degree of color selection is large and accord-

ingly a suitable color for improving the visibility can be selected. In addition, the light reflected by the light control member is irradiated parallel to the road or in a crossing direction of the road, and the color of the reflected light can be changed correspondingly for displaying signs, such as, pedestrian crossing, an intersection, a stop line, a railroad crossing, etc. at different locations. Therefore, these locations can be distinguished.

According to an embodiment of the present invention, since the light from the light projection unit is reflected towards the light projection unit, the light reflected by the light control member can be prevented from reaching the carrigeway, and the occurrence of discomfort glare and disability glare, etc. can be reduced. In addition, the road boundary can be clearly indicated because the amount of light between the light projection unit and the light control member is increased.

In one embodiment of the above road-guidance indicating device, the light control member is constructed in a manner that the light reflected by the light control member is irradiated parallel to the road or in a crossing direction of the road.

In an embodiment of the present invention, the light control member is constructed in a manner that the light reflected by the light control member is irradiated parallel to the road or in a crossing direction of the road. For example, irradiating the reflection light from the light control member to the crossing direction of the road can allow the people or drivers notice the locations of pedestrian crossing, an intersection, a stop line, a railroad crossing, etc. In addition, irradiating the reflected light from the light control member parallel to the road (the longitudinal direction of the road) can make the drivers notice the shape of the road, and therefore, a visual guiding effect can be expected.

According to an embodiment of the present invention, in addition to aforementioned effects, since the attention of the people or the drivers can be drawn to notice the locations of pedestrian crossing, an intersection, a stop line, a railroad crossing, etc., a more safer road guidance can be implemented. In addition, if the reflected light is irradiated parallel to the longitudinal direction of the road, a visual guiding effect can be expected.

In one embodiment of the above road-guidance indicating device, the light control member is installed at a height equal to or larger than 1.5 m from the carrigeway.

In one embodiment of the present invention, the light control member is installed at the position above 1.5 m from the carrigeway. The reason of setting the height above 1.5 m is that it is a range where the children's hands cannot reach. If the snowfall or the surrounding structure is generally 1.5 m or more, the children will not directly look at the high intensity portion of the beam center of the light source.

According to the present invention, the occurrence of discomfort glare and disability glare can be reduced because the children will not directly look at the high intensity portion of the beam center of the light source.

According to one embodiment of the invention, by using a lamp rather than the laser irradiation device, a light with a peak luminosity of 30000 cd or more is projected from the light projection unit. Namely, by projecting a light with a peak luminosity equal to or larger than the peak luminosity of the headlight of the car running on the road, the light output can be easily large and a thick light pillar can be formed. Furthermore, since the degree of color selection of the light is high, the visibility of the light pillar in the bad weather can be improved. In addition, since a lamp other than the laser light source is used, the light output is large and a thick light pillar can be formed, so that the road indication device can be inexpensive and compact. Therefore, the arrow sign can be set with the ordinary illumination apparatus on the road.

According to one embodiment of the invention, by setting the ½-beam angle of the light projected from the light projection unit equal to or less than 1° and the 1/10-beam angle of the light projected from the light projection unit equal to or less than 2°, the light pillar can be clearly identified and the visibility can be improved.

According to one embodiment of the invention, by setting the shortest length of the irradiation surface of the 1/10-beam angle of the light projected from the light projection unit larger than or equal to 50 mm and less than or equal to 300 mm, the visibility in the bad weather can be improved when the shortest length is less than 50 mm and the cross section of the light is too thin. In addition, it can also avoid a diseconomy when the shortest length exceeds 300 mm to increase the power of the lamp and the device volume. Furthermore, by setting the shortest length to 100 mm to 300 mm, preferably 200 mm to 300 mm, a good visibility can be obtained.

According to one embodiment of the present invention, since the luminosity at 90 degrees with respect to a vertical direction of the light projected from the light projection unit is equal to or less than 10 cd per lamp beam 1000 lm, and the luminosity at 80 degrees with respect to the vertical direction is equal to or less than 30 cd per lamp beam 1000 lm, the occurrence of glare to the driver of the car running on the road can be suppressed.

According to one embodiment of the present invention, the strong light beam irradiated from the light projection unit can be guided by the light guiding device. In this way, an acuter light beam can be irradiated towards the carrigeway. Therefore, even in the bad weather, the visibility of the light pillar can be improved and the position on the road can be affirmatively guided and indicated. In addition, if the side face of the light guiding device also glows, the road boundary can be easily indicated even in the stormy weather since the driver can identify the light guiding device.

According to one embodiment of the present invention, both of the light beam and the arrow sign can glow, and therefore, the driver can easily identify the road boundary.

According to one embodiment of the present invention, since the light from the light projection unit can be prevented from reaching the carrigeway by using the light control member, the occurrence of discomfort glare and disability glare, etc. when gazing the light projection unit from below can be effectively reduced.

According to one embodiment of the present invention, since the light from the light projection unit is reflected towards the light projection unit, the light reflected by the light control member can be prevented from reaching the carrigeway, and the occurrence of discomfort glare and disability glare, etc. can be reduced. In addition, the road boundary can be clearly indicated because the light amount between the light projection unit and the light control member is increased.

According to one embodiment of the present invention, since the attention of the people or the drivers can be drawn to notice the locations of pedestrian crossing, an intersection, a stop line, a railroad crossing, etc., a more safer road guidance can be implemented. In addition, if the reflection light is irradiated parallel to the longitudinal direction of the road, a visual guiding effect can be expected.

According to one embodiment of the present invention, the occurrence of discomfort glare and disability glare to the

children can be reduced because the children will not directly look at the high intensity portion of the beam center of the light source.

BRIEF DESCRIPTION OF THE DRAWINGS

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention, the objects and features of the invention and further objects, features and advantages thereof will be better understood from the following description taken in connection with the accompanying drawings.

FIG. **1** is a diagram showing a use status of a road indication device according to the first embodiment of the present invention.

FIG. **2** is a structure diagram of the road indication device of FIG. **1**.

FIG. **3** is a diagram showing a use status of the road indication devices of FIG. **1**. arranged on the road with a predetermined distance.

FIG. **4** is a graph showing a light distribution of the road indication device of FIG.**1**.

FIG. **5** is a diagram showing status at vertical angles of 90° and 80° relative to the vertical direction.

FIG. **6** is a perspective view showing an arrow sign that is used together with the road-guidance indicating device according to the second embodiment of the present invention.

FIG. **7**A to FIG. **7**C are a front view, a side view and a bottom view of the road indication device according to the third embodiment of the present invention, and FIG. **7**D is a back view of an arrow sign.

FIG. **8** is a diagram showing a use status of the road indication device according to the fourth embodiment of the present invention.

FIG. **9** is a diagram showing a use status of a road indication device according to the fifth embodiment of the present invention.

FIG. **10** is a diagram showing a use status of the road-guidance indicating device according to the sixth embodiment of the present invention.

FIG. **11** is a plane diagram showing a use status of a road indication device according to an embodiment of the present invention.

FIG. **12** is a diagram showing a use status of a road indication device according to the seventh embodiment of the present invention.

FIG. **13** is a diagram showing a use status of a road indication device according to the eighth embodiment of the present invention.

FIG. **14** is a cross-sectional view of an illumination device comprising the road indication device according to the ninth embodiment of the present invention.

FIG. **15** is a block diagram of the road indication device of FIG. **14**.

FIG. **16** is a diagram showing a use status of a road indication device according to a tenth embodiment of the present invention.

FIG. **17** is a diagram showing a use status of the road indication device according to the eleventh embodiment of the present invention.

FIG. **18** is a diagram showing a use status of the road indication device according to the twelfth embodiment of the present invention.

FIG. **19** is a perspective view showing an arrow sign used together with the road indication device according to the twelfth embodiment of the present invention.

FIG. **20** is a diagram showing a use status of a road indication device according to the thirteenth embodiment of the present invention.

FIG. **21** is a diagram showing a use status of a road indication device according to the fourteenth embodiment of the present invention.

FIG. **22** is a diagram showing a use status of a road indication device according to the fifteenth embodiment of the present invention.

FIG. **23** is a diagram showing a use status of a road indication device according to the sixteenth embodiment of the present invention.

FIG. **24** is a side-view diagram viewed from a arrow direction in FIG. **23**.

FIG. **25** is a diagram showing a use status of a road indication device according to the seventeenth embodiment of the present invention.

FIG. **26** is a structure diagram of the road indication device according to the seventeenth embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

First Embodiment

The embodiments according to the present invention will be described in detail accompanying with the attached drawings. FIG. **1** to FIG. **5** illustrate the views of a road indication device according to the first embodiment according to the invention. FIG. **1** is a diagram showing a use status of a road indication device, FIG. **2** is a block diagram showing a structure of the road indication device, FIG. **3** is a diagram showing a use status where the road indication devices are set at a predetermined distance on the road, FIG. **4** is a graph showing a light distribution of the road indication device, and FIG. **5** shows status at vertical angles of 90° and 80° relative to the road indication device.

As shown in FIG. **2**, the road indication device **11** comprises a case **13** with a light projection opening **12** for projecting the light at one end along a light axis. A lamp **14**, i.e., an HID (high intensity discharge) lamp such as a metal halide lamp, a halogen lamp, an ultra high pressure mercury (UHP) lamp with an electrode distance less than 1.5 mm is received in the case **13** and serves as a light source. An optical system **18** is further received in the case **13** and serves as light control means for controlling the light of the lamp **14**. The optical system **18** comprises a reflection mirror **15** for focusing and reflecting the light from the lamp **14** along an axial direction of the light from the reflection mirror **15**, and the aperture **16** for forming a circular opening at the focus of the reflection light reflected by the reflection mirror **15**, and a lens **17** for condensing the light passing through the opening of the aperture **16** parallel with the light axial direction. Furthermore, a ballast (light control member) **19** is also included in the case **13** for serving as a lighting device to light the lamp **14**. The light projection opening **12** of the case **13** is covered by a protection plate **20** with transmittance that is made of glass or resin. The light projection unit **21** is constructed to include the case and the optical system **18**, and projects a light **22** having a peak brightness equal to or larger than 30000 cd. The color of the light **22** can be white or a color according to a background color.

The ballast **19** is controlled by the control unit **23**, and the control unit **23** is adapted for controlling a light output, including turning on and off the lamp **14**, according to the

environment, such as snowfall, rainfall, fog and traffic, etc. For example, according to a detection result from the detecting device **24** that detects a snowfall amount (also for a rainfall amount and a fog density, etc.), the lamp **14** is usually turned on with a rated output when the snowfall amount exceeds a predetermined amount. The control units **23** can control the lamp **14** to reduce its light output when the snowfall amount decreases. This control scheme can be executed by a program set by beforehand experiments. In addition, for example, according to time information from the timer **25**, the lamp **14** is usually lit from the evening to the midnight, and the lamp **14** is controlled according to the traffic volume and the time zone in a manner that the light output of the lamp **14** is reduced from the midnight to the morning when the traffic volume of cars, etc. becomes small. Furthermore, the detecting device **24** used in the environment detection can utilize an environment transmissometer. The laser beam is irradiated from the light projection unit **21** to the receiver, and the surrounding environment status, such as the snowfall amount, the rainfall amount and the fog density, etc. can be found from a ratio of the light amount reaching the receiver.

As shown in FIG. **1**, the driveway **28** and the shoulder **29** are formed along a boundary **30** on the road **27**. A plurality of posts **31** standing on the shoulder **29** at a predetermined interval whose tops are bent toward the driveway **28**. A road indication device **11** for projecting a light to the boundary **30** on the pavement **27***a* of the road **27** is installed at the top end of each post **31**, wherein a light projection opening **12** of the road indication device **11** is directed downwards. Furthermore, an arrow sign **32**, i.e., a plate-shaped sign where an arrow is protruded from the lower end of the road guidance indicating device **11** and formed at the front end (or lower end with respect to the road **27**) of road indicating device **11**, is installed on the road indication device **11** or the post **31** at a position that is irradiated by a portion of the light **22** projected from the road-guidance indicating device **11**. Namely, the arrow sign **32** is installed in a manner that a portion of the light **22** is irradiated to the plate surface opposite to the moving direction of the car A that runs on the road **27**.

In cases other than the bad weather such as the snowfall, the rainfall and the fog, the visibility of the arrow sign **40** is still good, and the driver who drives the car A on the road **27** can confirm the boundary **30** between the road **27** and the shoulder **29** by the light pillars **22** of the light **22** formed with a predetermined distance along the road **27**.

In the bad weather such as the snowfall, since the rainfall and the fog, the guiding indication is not sufficient by only the arrow sign **32**, the lamp **14** of the road indication device **11** is lit. By lighting the lamp **14**, the light of the lamp **14** is reflected by the reflection mirror **15**. Then, the reflection light passes through the opening of the aperture **16** for cutting the expanse of the light **22** that expand to the surroundings, and then condensed by the lens **17** to a parallel light **2** in the axial direction. After passing through the light projection opening **12**, the light **22** is projected towards the boundary **30** between the driveway **28** and the shoulder **29**.

The projected light irradiates the snow in the snowfall, and the rain in the rainfall, and the fog, etc. and the snow, the rain and the fog glisten, which can be visible as one light pillar **22***a* of the light **22** from the road indication device **11** to the pavement **27***a* of the road **27**. Therefore, as shown in FIG. **3**, the driver who drives the car A on the road **27** can confirm the boundary between the road **27** and the shoulder **29** by the light pillars **22** of the light **22** formed with a predetermined distance along the road **27**, while confirming the route of the road **27**.

Since the luminosity of the light pillar **22***a* of the light **22** is equal to or larger than the peak luminosity of the headlight of the car A running on the road **27**, the light pillar **22***a* of the light can be affirmatively confirmed even though the light of the headlight is irradiated to the light pillar **22***a* of the light **22**.

FIG. **4** shows a relationship between the emitting angle and the luminosity of the light **22** projected from the light projection unit **21**, i.e., the road-guidance indicating device **11**, which is result measured by experiments under a snowfall environment. At this time, the peak luminosity is 1400000 cd. The opening of the aperture **16** for cutting the expanse of the light **22** that expands to the surrounding is ϕ2.5 mm for case (a), and ϕ5 mm for case (b).

For the case (a) that the opening of the aperture **16** is ϕ2.5 mm, a ½-beam angle, i.e., 1400000/2=700000 cd is 0.9° and a 1/10-beam angle, i.e., 1400000/10=140000 cd is 1.29°. In addition, for the case (b) that the opening of the aperture **16** is ϕ5 mm, a ½-beam angle, i.e., 1400000/2=700000 cd is 1.0° and a 1/10-beam angle, i.e., 1400000/10=140000 cd is 2.0°.

The light pillar **22***a* of the light **22** can be precisely identified by setting the ½-beam angle equal to or less than 1° and the 1/10-beam angle equal to or less than 2°. Namely, if the ½-beam angle is larger than 1° and the 1/10-beam angle is larger than 2°, the light pillar **22***a* of the light **22** cannot be precisely identified.

In this manner, the 1/10-beam angle is used as the diameter of the light pillar **22***a* of the light **22** to perform the experiment. For example, the light projection unit **21** of the road indication device **11** is installed at a height of 5 m from a irradiation surface of the road **27**.

TABLE 1 shows the visibility of the light **22** under the snowfall condition when the 1/10-beam angle of a circular irradiation surface is set as the diameter and a distance between the road-guidance indicating devices **11** is 40 m, 60 m and 80 m.

The ϕ5 mm case is an example of using a laser beam like the conventional art. The diameter of the respective irradiation surface is set by changing the distance between the lens **17** and the lamp **14**.

As shown in TABLE 1, the light pillar **22***a* of the light **22** cannot be recognized by a laser beam of ϕ5 mm, and light pillar **22***a* of the light **22** can be recognized by a laser beam of ϕ50 mm or more. A laser beam of ϕ100 to 300 mm is preferred, and a laser beam of ϕ200 to 300 mm is more preferable. In addition, as the diameter of the laser beam exceeds ϕ300 mm, the power consumption of the lamp **14** will increase and the device size will also increase, which is not very economic.

TABLE 1

	ϕ5 mm	ϕ50 mm	ϕ100 mm	ϕ200 mm	ϕ300 mm
40 m	X	○	○	○	○
60 m	X	Δ	○	○	○
80 m	X	Δ	Δ	○	○

Furthermore, in the road indication device **11**, the light distribution is controlled by the optical system of the projection unit **21** so as to suppress the occurrence of glare to a driver who drives the car A on the road **27**. As shown in FIG. **5**, when the light **22** is projected downwards from the

light projection unit **21** in the vertical direction Y, the luminosity at 90-degree direction with respect to the vertical direction Y is 10 cd or less per lamp beam 1000 lm, and the luminosity at 80-degree direction with respect to the vertical direction Y is 30 cd or less per lamp beam 1000 lm. This is equivalent to a cut-off form luminosity of road illumination apparatus specified by JIS C8131, and can prevent the occurrence glare to the driver who drives the car A on the road **27**.

For various lamps **14** with different lamp powers, peak brightness and electrode distances, a result of measuring a light utilization efficiency by experiments under a snowfall environment is shown in TABLE 2. The lamps **14** for comparison are ultrahigh pressure mercury lamp (UHP), ceramic metal halide lamp (CDM) and HID lamp for automobile.

	UHP	CDM	HID lamp for automobile
lamp power [W]	100	75	35
peak luminosity [cd]	1400000	50000	200000
electrode distance [mm]	1.2	4 or more	4
light utilization efficiency [cd/W]	14000	1111	5714

According to the result in TABLE 2, one can confirm that the UHP lamp with an electrode distance equal to or less than 1.5 mm has a maximum light utilization efficiency. Therefore, by using the UHP lamp with an electrode distance equal to or less than 1.5 mm as the lamp **14**, the visibility of the light pillar **22***a* of the light **22** can be improved. Furthermore, the power consumption (Watt) can be reduced by adjusting the light amount according to the weather.

As described above, according to the road indication device **11**, by projecting a light whose peak brightness that the light of the lamp **14** is collimated by the lens **17** is 30000 cd or more, i.e., by projecting the light **22** whose peak brightness is higher than the peak brightness of the head light of the car A running on the road **27**, the light pillar **22***a* can be formed with a high and thick light output, and the light pillar **22** of the light **22** can be exactly recognized even though the light of the head light of the car A irradiates to the light pillar **22***a* of the light **22**. Therefore, the visibility of the light pillar **22***a* of the light **22** can be improved in the bad weather, and the position of the boundary **30** on the road **27** can be exactly indicated.

For example, the UHP lamp, the CDM lamp and the HID lamp for automobile can be used as the lamp **14** in the road-guidance indicating device **11**, and therefore, the color of the light **22** can be selected in a manner that the light **22** can be easily recognized in the bad weather. Since the degree of freedom of selecting the light color is high, the visibility of the light pillar **22***a* of the light **22** can be improved in the bad weather, and the position of the boundary **30** on the road **27** can be precisely indicated. In this case, for example, the colors of the lamps **14** for the up and the down lines on the road **27** can be changed, and therefore, the up and the down lines on the road **27** can be easily recognized.

For example, during snowfall, the control unit **23** controls the lamp **14** to turn on with its rated output in usual way when the snowfall amount reaches a predetermined snowfall amount, and therefore, the visibility can be maintained. In addition, when the snowfall amount decreases, the light output of the lamp **14** will be reduced to save the energy.

Furthermore, the control unit **23** controls the lamp **14** according to a traffic condition and a time zone so that the lamp **14** is turned on in a usual way from the evening to the midnight and turned on from the midnight to the morning when the traffic volume is small. In this way, the energy consumption can be saved.

In particular, the lamp **14** of the road indication device **11** can be turned on only when the car A drives through a road on the mountain where the traffic is small, and thereby, the energy can be saved. This can be implemented by setting a car passing sensor in front of the road-guidance indicating device **11**, for example detecting the car by the blockade of the infrared ray, the road-guidance indicating device **11** can be turned on only when the car passing sensor detects the car A passing through. At this time, a plurality of road indication devices **11** can be controlled by the car passing sensor, and the plurality of road indication devices **11** can be turned on according to the movement of the car A and a time difference.

TABLE 3

	light output	
environment	usual output	reduced output
snowfall or rainfall amount	large	small
fog density	dense	thin
time zone	evening to midnight	might night to morning
traffic volume	large	small

In addition, when the lamp **14** of the road indication device **11** is turned on, a portion of the projecting light **22** is irradiated to the surface of the arrow sign **32** and the surface of the arrow sign **32** shines. Therefore, the visibility can be further improved by using the light pillar **22***a* of the light **22** and the arrow sign **22**.

Second Embodiment

FIG. **6** shows a road indication device according to the second embodiment of the present invention. As shown in FIG. **6**, by bending a reflection portion **32***a* from the edges of an arrow portion at the lower end of the arrow sign **32** to a surface where the light **22** is irradiated there to, the reflection light reflected by the reflection portion **32***a* is irradiated to the surface of the arrow sign **32**. As a result, the arrow sign **32** becomes brighter and the visibility can be further improved.

In addition, the light projection direction of the light **22** of the road indication device **11** can be constructed to alternatively move between the direction of the pavement **27***a* and the direction of the arrow sign **32** based on the time zone, etc. under the control of the control unit **23**. For example, the light **22** of the road indication device **11** is usually projected towards the pavement **27***a* of the road **27**, and projected towards the arrow sign **32** in the late-night time zone when the traffic is small, so that the light output by the lamp **14** can be reduced. In this manner, the visibility of the arrow sign **32** can be still maintained and the energy consumption can be also saved.

Third Embodiment

FIG. **7** shows a road indication device according to the third embodiment of the present invention. As shown in FIG. **7**, the arrow sign **32** comprises a long base **34** extending in an up-and-down direction and a arrow portion **35** that is substantially triangular and connected to the lower end of the base **34**. The long base **34** and the arrow portion **35** are

bent to a convex surface that the central portion of the face opposite to the face where the light projection unit **21** is installed thereon is convex.

On the face where the light projection unit **21** of the base **34** is installed, a rail **27** with a groove **36** is installed along the up-and-down direction. Link means **38**, including bolts, formed at two locations (up and down) on the side face of the light projection unit **21** is slidably engaged and fixed to the groove **36** of the rail **37**. Therefore, the position of the arrow sign **32** can be adjusted up and down with respect to the light projection unit **21**. Installation metal fittings **39** are installed at the upper end of the light projection unit **21** for mounting the light projection unit **21** to the post **31**.

Fourth Embodiment

FIG. **8** shows a road indication device according to the fourth embodiment of the present invention. As shown in FIG. **8**, the angle of the projection direction of projecting the light **22** from the light projection unit **21** is opposite to the moving direction F of the car A. Namely, by directing the light **22** towards the driver of the car A driving on the driveway **28**, the brightness of the light pillar **22***a* of the light **22** seen by the driver can be increased, and therefore, the visibility can be improved. The angle α of the light **22** with respect to the pavement **27***a* of the road **27** is preferably set at a range of $0<\alpha<45°$. If the angle α is equal to or larger than 45°, the driver will feel dizzy.

Fifth Embodiment

FIG. **9** shows a road indication device according to the fifth embodiment of the present invention. As shown in FIG. **9**, the angle of the projection direction of projecting the light **22** from the light projection unit **21** is varied with a predetermined period corresponding to the moving direction F of the car A. In this way, the brightness and the position of the light pillar **22***a* of the light **22** seen by the driver are varied, and therefore, the visibility can be improved. Furthermore, since the light **22** can repeatedly move along the boundary **30** between the driveway **28** and the shoulder **29** and a wide range of the boundary **30** is irradiated, the boundary **30** can be easily identified by eyes.

Sixth Embodiment

FIG. **10** shows a road indication device according to the sixth embodiment of the present invention. FIG. **10** shows an elliptical light projected from the light projection unit **21**. The light **22** from the lamp **14** becomes elliptical at an irradiation plane due to the shape of the lens **17** of the light projection unit **21** of the road-guidance indicating device **11**. For example, the light **22** of such irradiation form can be obtained with the lens **17** of form like a revolution body rotated the semi-cylindrical shape centering on the lamp. In this embodiment, the light **22** is irradiated in a manner that the major axis of projected light shape is directed along the passing direction F of the road **27** and the minor axis is directed along the cross section of the shoulder **29**. By using this configuration, since the light pillar **22***a* of the light **22** seen by the driver is seen as a curtain along the shoulder **29** of the road **27**, the boundary **30** of the road **27** can be spatially recognized

Seventh Embodiment

FIG. **12** shows a road indication device according to the seventh embodiment of the present invention. As shown in FIG. **12**, the road indication device **11** is buried in the pavement **27***a* of the road **27** according to the position of the boundary **30**, and thus the light **22** is projected upwards from the pavement **27***a* of the road **27**. In this case, the snow covering the protection plate **20** of the projection opening **12** of the road-guidance indicating device **11** is melted due to the heat created by the lamp **14**, a projection light amount of the light **22** can be maintained. In addition, since the post **31**, etc. for mounting the road indication device **11** is not stood above the pavement **27***a* of the road **27**, the natural landscape can be maintained. Furthermore, the maintenance can be easier because the road indication device **11** is located at a low position.

In addition to burying the road indication device **11** in the pavement **27***a* of the road **27**, the road-guidance indicating device **11** can also be arranged with a post of a guard rail formed on the shoulder **29**.

Eighth Embodiment

FIG. **13** shows a road indication device according to the eighth embodiment of the present invention. FIG. **13** shows an example of the road indication device **11** used in a guidance indicator for a crossing or a signal of temporary stop. A post **41** is erected at one side of the road **27**. The road indication device **11** for projecting the light **22** to the other side of the road **27** is horizontally mounted atop the post **41**, i.e., the road indication device **11** is set in a manner that the light projection opening **12** is directed towards the other side of the road **27**. A light receiving unit **42** is erected at the other side of the road **27** for receiving the light **22** projected from the road indication device **11**.

In this way, since the light pillar **22***a* of the light **22** projected from the road indication device **11** crosses over the road **27** in the horizontal direction, the road indication device **11** can be used to guide and indicate a crossing or a signal of temporary stop.

Ninth Embodiment

FIGS. **14** and **15** shows a road indication device according to the ninth embodiment of the present invention. As shown in FIG. **14**, a usual illumination apparatus **52** and the road indication device **11** integrated together as an illumination device **51**, and the illumination device **51** is installed on the post **31** erected on the shoulder **29** of the road **27**.

The illumination apparatus **52** comprises an apparatus body **53**. An installation part **54** for installing the illumination device **51** to the post **31** is formed at the base end of the apparatus body **53**. The illumination apparatus **52** for mainly illuminating the driveway of the road **27** is arranged inside the front end of the apparatus body **53**. The road-guidance indicating device **11**, for projecting the light **22** to the boundary **30** between the driveway **28** and the shoulder **29** of the road **27**, is arranged inside the base end of the apparatus body **53**.

The illumination apparatus **52** comprises a lamp **56**, a reflection mirror **57** and a cover **58**. The lamp **56** can be a metal halide lamp, etc. for example. The reflection mirror **57** is used to reflect the light of the lamp **56** towards the road **27** below. The cover **58** is installed onto a lower opening **53***a* of the apparatus body **53** and is made of glass that is subjected to an enhancement process (including thermal process).

The road indication device **11** is set in the apparatus body **53** so that the light projection opening **12** is adjacent to the lower opening **53***b* of the apparatus body **53**. Since the apparatus body **53** is thin along the up-and-down direction, the light projection unit **21** having the optical system **18** and the ballast **19** are separated and the ballast **19** is arranged in a lateral space next to the light projection unit **21**.

Referring to FIG. **15**, lighting the illumination apparatus **52** and the road indication device **11** is controlled by an illumination control unit **59**. The illumination control unit **59** functions to alternatively light the illumination apparatus **52**

and the road-guidance indicating device **11** according to a detection of an illumination environment detecting device **60** that detects an ambient brightness and an environment condition (such as weather condition). For example, if it gets dark and not in a bad weather condition, such as snowfall, rainfall, or fog, etc., the illumination apparatus **52** is turned on and the road indication device **11** is turned off. In addition, when in the bad weather condition, such as snowfall, rainfall, or fog, etc., the illumination apparatus **52** is turned off and the road indication device **11** is turned on. In other words, when the illumination apparatus **52** is turned off, the road-guidance indicating device **11** is turned on, and vice-versa.

The illumination environment detecting device **60** utilizes an illuminometer arranged in the apparatus body **53** and a brightness photometer, etc. to detect the ambient brightness, and utilizes an atmosphere transmissometer, etc. arranged outside the apparatus body **53** to detect a snowfall amount, a rainfall amount and a fog density, etc.

Then, when it gets dark and not in a bad weather condition, such as snowfall, rainfall, or fog, etc., only the illumination apparatus **52** is turned on to illuminate the road **27**.

On the other hand, in the bad weather condition, such as snowfall, rainfall, or fog, etc., only the road indication device **11** is turned on to guide and indicate the boundary **30** between the driveway **28** and the shoulder **29** by the light pillar **22***a* of the light **22** from the road-guidance indicating device **11** to the pavement **27***a* of the road **27**. When the illumination apparatus **52** is turned on in the bad weather, the light will irradiate the snow, etc. in a coverage area under the illumination apparatus **52** to create alight curtain. At this time, since the illumination apparatus **52** is turned off, the occurrence of light curtain and disability glare can be effectively reduced.

As described above, since illumination device **51** includes the illumination apparatus **52** to illuminate the pavement **27***a* of the road **27** and the road-guidance indicating device **11** to project the light towards the pavement, the usual road illumination and the guiding indication for bad weather, etc. can be alternatively switched by one illumination device **51**.

For example, by alternatively turning on the illumination apparatus **52** and the road indication device **11** according to the ambient brightness and the environment condition (such as the weather condition), the usual road illumination and the guiding indication for bad weather, etc. can be alternatively switched by one illumination device **51**.

Tenth Embodiment

FIG. **16** shows a road indication device according to the tenth embodiment of the present invention. FIG. **16** shows of the road indication device in use. As shown in FIG. **16**, on the post **31** or the light projection unit **11**, a light guiding device **40** is installed at a position where a portion or all of the light **22** projected from the light projection unit **11** are guided, and is protruded from the lower end of the light projection unit **11**. The light guiding device **40** comprises a light pipe, a light guide and an optical fiber. A sharpened light beam can be irradiated by installing the light guide device **40**. In addition, by constructing the light guiding device **40** in a manner that the light is irradiated from the side face of the light guiding device **40**, the light guiding device **40** can also gleam when the driver watches it.

In addition, in a bad weather condition, such as snowfall, rainfall or fog, etc., the lamp **14** of the light projection unit **11** is fully lit since the guiding indication using only light guiding device **40** is insufficient. By lighting the lamp **14**, the light of the lamp **14** is reflected by the reflection mirror **15**, and the reflection light passes through the opening of the aperture **16** for cutting the expanse of the light **22** that expands to the surrounding. Then, the reflection light is focused by the lens **17** to render the light substantially parallel along the light axis. The light **22** is then projected towards the boundary **30** between the driveway **28** and the shoulder **29** through the light projection opening **12** and the light guiding device **40**.

Since the projected light irradiated to the snow, the rain and the fog, etc. and the snow, the rain and the fog glow, a light pillar from the light projection unit **11** to the paving **27***a* can be visually identified, so that the boundary **30** between the driveway **28** and the shoulder **29** can be guided and indicated by the light pillar **22***a*. Therefore, the driver can drive the car A on the driveway **28** safely while confirming the boundary **30** between the driveway **28** and the shoulder **29**, and thereby confirming the route of the road **27** by the light pillars **22***a* set with a predetermined distance along the road **27**.

Since the luminosity of the light pillar **22***a* of the light **22** is equal to or larger than the peak luminosity of the headlight of the car A running on the road **27**, the light pillar **22***a* of the light **22** can be affirmatively recognized even though the light of the headlight is irradiated to the light pillar **22***a* of the light **22**.

In the bad weather such as snowfall, the rainfall and the fog, etc., the light of the lamp is condensed onto the road by the lens **17**, so that a light with a peak luminosity of 30000 cd or more is projected from the light projection unit. Namely, by projecting a light with a peak luminosity equal to or larger than the peak luminosity of the headlight of the car running on the road, the light output can be high and a thick light pillar can be formed. In addition, since the light pillar **22***a* of the light **22** can be affirmatively identified even though the light of the headlight of the car A is irradiated to the light pillar **22***a* of the light **22**, the visibility of the light pillar **22***a* can be improved in the bad weather and the boundary **30** on the road **27** can be precisely guided and indicated. In addition, in the weather condition other than the bad weather such as the snowfall, the rainfall and the fog, the position of the boundary **30** on the road **27** can be affirmatively guided and indicated by the glowing light guiding device **40**. When the weather condition is not bad, the lamp **14** can be adjusted in a manner to only glow the light guiding device **40**. In this manner, the driver can be guided to recognize the shoulder. Furthermore, the lamp **14** is controlled according to the traffic and the time zone in a manner that the lamp **14** is adjusted to turn on from the evening to the midnight and the light output is reduced from the midnight to the morning. In this way, the energy consumption can be saved.

Eleventh Embodiment

FIG. **17** shows a road indication device according the eleventh embodiment of the present invention. As shown in FIG. **17**, an indication, such as "WATCH WHILE DRIVING", is provided on a side face of the light guiding device **41**, and only the indication portion gleams. This can attract the attention of the driver.

Twelfth Embodiment

FIG. **18** shows a road indication device according to the twelfth embodiment of the present invention. As shown in FIG. **18**, the arrow sign (plate sign) **32** whose front end, i.e., lower end is formed in an arrow shape is installed at a position that is illuminated by a portion of the light **22** projected from the light projection unit **11**, and is protruded from the lower end of the light projection unit **11**. The arrow

sign **32** is installed in a manner that a portion of light **22** is irradiated to the plate surface facing the driving direction where the car A runs on the driveway **28**. The surface of the arrow sign **32** is coated with a reflection material, or the arrow sign **32** can be formed with a reflection material.

As shown in FIG. **19**, by bending a reflection portion **32***a* from the edges of an arrow portion at the lower end of the arrow sign **32** to a surface where the light **22** is irradiated there to, the reflection light reflected by the reflection portion **32***a* is irradiated to the surface of the arrow sign **32**. As a result, the arrow sign **32** becomes brighter and the visibility can be further improved.

Thirteen Embodiment

FIG. **20** shows a road indication device according to the thirteenth embodiment of the present invention. As shown in FIG. **20**, a ribbon **42** is installed at a position that is illuminated by a portion of the light **22** projected from the light projection unit **11**, and is protruded from the lower end of the light projection unit **11**. The ribbon **42** is installed in a manner that a portion of light **22** is irradiated to the plate surface facing the driving direction where the car A runs on the driveway **28**. The surface of the ribbon **42** is coated with reflection material, or the arrow sign **32** can be formed with reflection material. The weight becomes light by using the ribbon **42**??, and the ribbon **42** can be used as a vane because the ribbon **42** can detect the wind, etc.

Fourteenth Embodiment

FIG. **21** shows an appearance diagram of a road indication device according to the fourteenth embodiment of the present invention. As shown in FIG. **21**, the road-guidance indicating device **11** comprises a light projection unit **21** and a light control member **50**. An arrow sign **32** is installed in front of the road-guidance indicating device **11**. Therefore, the light projection unit **21** is located behind the arrow sign **32**. The light projection unit **21** and the light control member **50** are installed on a post **31**. The post **31** is erected on the shoulder **29** of the road **27**. Namely, the driveway **28** and the shoulder **29** are formed along a boundary **30** on the road **27**, and the post **31** is stood on the shoulder **29**. The post **31** is formed in a manner that its upper end is bent towards the side of the driveway **28**, and a plurality of posts **31** is erected on the shoulder **29** at a predetermined interval.

The light projection unit **21** for projecting the light towards the boundary **30** of the pavement **27***a* of the road **27** is installed at the upper end of each post **31**, and the light projection opening is directed downwards. The light control member **50** is arranged between the pavement **27***a* and the light projection unit **21**. The light control member **50** is installed in a manner to reduce the possibility of the light **22** (irradiated from the light projection unit **21** towards the paving **27***a*) from reaching the pavement **27***a* of the road **27**. In FIG. **21**, the light control member **50** is installed in a direction to reflect the light **22** to the light projection unit **21**. In this case, the reflection light reflected by the light control member **50** is reflected towards the light projection unit **21**.

For preventing children from directly gazing the high intensity of light at the beam center the light source of the light projection unit **21**, the installation position of the light control member **50** is positioned at 1.5 m or more above the pavement **27***a* of the road, where hands of children cannot reach. If the snowfall amount or the surrounding structure is generally 1.5 m or more, the children cannot gaze the central portion of the light source.

The surface of the light control member **50** facing the light projection unit **21** is formed with a mirror surface capable of reflecting light, or a light shielding surface for absorbing light. When the surface of light control member **50** facing the light projection unit **21** is formed with the mirror surface, the boundary **30** of the road can be more clear because the light amount between the light projection unit **21** and the light control member **50** is increased. In general, since the arrow sign **32** is set in front of the light projection unit **21** opposite to the driving direction of the car A, the reflection light from the light control member **50** is irradiated to the arrow sign **32**, and the visibility of the arrow sign **32** can be increased.

On the other hand, when the surface of light control member **50** facing the light projection unit **21** is formed with a black surface for absorbing light, the leakage light reflected by the light control member **50** can be prevented from reaching the paving of the road **27** since the light from the light control unit **21** is absorbed and shielded by the light control member **50**. Therefore, the occurrence of disability glare and discomfort glare, etc. due to the reflected light from the light control member **50** can be prevented.

As described above, the direct light and the reflection light from the light projection unit **21** can be prevented from reaching the pavement of the road **27**, and the boundary **30** of the road **27** can be recognized by the light between the light projection unit **21** and the light control member **50**. In this way, the driver of the car A can be guided by the light between the light projection unit **21** and the light control member **50** so as to drive the car A safely.

According to the fourteenth embodiment of the present invention, since the light from the light projection unit **21** is reflected towards the light projection unit **21** by the light control member **50**, the reflected light from the light control member **50** can be prevented from reaching the pavement of the road, and the occurrence of disability glare or discomfort glare, etc. due to the reflected light from the light control member **50** can be reduced. In addition, the visibility of the road boundary can be improved since the light amount between the light projection unit **21** and the light control member **50** is increased. Furthermore, when the arrow sign is arranged in front of the light projection unit **21**, the boundary **30** of the road **27** can be guided by not only the light between the light projection unit **21** and the light control member **50** but also the arrow sign **32** because the arrow sign **32** is irradiated by the reflected light. Additionally, since the light control member **50** is positioned at 1.5 m or more above the pavement of the road, it prevents the occurrence of disability glare or discomfort glare, etc. when gazing the light projection unit **21** from below.

Fifteenth Embodiment

FIG. **22** is view of a road indication device according to the fifteenth embodiment of the present invention. According to the fifteenth embodiment, the light control member **50** is installed in a manner that an installation angle of the light control member **50** is set to an angle that the reflected light from the light control member **50** is irradiated along the crossing direction of the road **27**.

In FIG. **22**, the reflected light from the light control member **50** is irradiated along the crossing direction of the road **27**. For example, the reflected light is irradiated along the crossing direction of the road **27** at locations of pedestrian crossing, an intersection, a stop line, a railroad crossing, etc. This way the attention of the driver can be attracted to notice the pedestrian crossing, the intersection, the stop line and the railroad crossing, etc. In addition, by changing the color of the reflected light, the intersection, the stop line and the railroad crossing, etc. can be recognized. For changing the color of the reflected light, a multi-coated film or a

filter for determining the color of the reflected light is formed on the mirror surface of the light control member **50**.

According to the fifteenth embodiment of the present invention, in addition to the effects described in the first embodiment, the attention of the driver can be drawn to notice the pedestrian crossing, the intersection, the stop line and the railroad crossing, etc. because the reflected light is irradiated along the crossing direction of the road **27**. In addition, the degree of selection of colors of the reflected light is large allowing selection of a suitable color for improving the visibility because the reflected light with a suitable color can be projected from the light control member **50**. For example, the color of the reflected light of the pedestrian crossing, the intersection, the stop line and the railroad crossing, etc. can be corresponding changed in order to draw the attention of the driver to notice these locations.

Sixteenth Embodiment

FIG. **23** is a view of a road indication device according to a sixteenth embodiment of the present invention. In FIG. **23**, the installation angle is set to an angle that the reflection light from the light control member **50** is irradiated parallel to the road **27**. FIG. **23** shows a situation that the reflection light is irradiated from a front direction to a back direction with respect to the drawing. Since the road indication device **11** is installed on the posts **31** that are erected along the road curve of the road **27** with a predetermined distance, the reflected light from the light control member **50** of each road indication device **11** can guide and indicate the road curve of road **27**.

FIG. **24** is a side-view of a road indication device viewed from the direction of the arrow in FIG. **23**. The light reflected by the light control member **50** is irradiated parallel to the road **27** is directed along the driving direction B of the car A. The reflected light from the light control member **50** can be also irradiated along a reverse direction relative to the driving direction B of the car A. However, it is preferable to reflect the reflection light **22** along the driving direction B of the car A because the reflected light will not directly incident to the eyes of the driver of the car A which would otherwise make the driver feel dizzy.

According to the sixteenth embodiment of the present invention, in addition to the effects described in the first embodiment, the road curve of the road **27** can be quickly identified as the driver's eyes can be effectively guided by the reflected light from the light control member **50** being irradiated parallel to the road **27** (the longitudinal direction of the road **27**).

As described above, the direction of the reflected light from the light control member **50** is irradiated in a parallel direction (longitudinal direction) or in a crossing direction of the road **27**. However, the direction of the reflected light from the control member **50** can be changed to an upward direction or tilted from the horizontal direction according to the requirement. In addition, the light control member **50** can be constructed in a manner that the angle of the light control member **50** is adjustable.

Seventeenth Embodiment

FIGS. **25** and **26** shows a road indication device according to a seventeenth embodiment of the present invention. FIG. **25** is used to describe a road indication device of the present invention in use and FIG. **26** shows a light projection unit of the road indication device.

In FIG. **25**, a wind driven generator **60** having a windmill **63** and a generating device **62** as well as a solar generator **64** are installed atop the post **31**. The wind driven generator **60** uses the rotation of the windmill **63** to generate power by using the generating device **62**. The electrical powers generated by the wind driven generator **60** and the solar generator are **34** are supplied to the light projection unit **21**.

As shown in FIG. **26**, the light projection unit **21** comprises a case **13** having a light projection opening **12** for projecting the light at one end along a light axis. A lamp **14** such as a metal halide lamp, an optical system **18**, a ballast **19**, a control unit **23**, a timer **25** and a storage battery **26** are installed in the case **13**, a. The optical system **18** comprises a reflection mirror **15** for focusing and reflecting the light from the lamp **14** along a direction of a light axis of the reflection mirror **15**, and aperture **16** for forming a circular opening at the focus of the reflection light reflected by the reflection mirror **15**, a lens **17** for condensing the light passing through the opening of the aperture **16** parallel with the direction of the light axis, and a rotational filter **17** capable of changing the color of the light. The ballast (light control member) **19** serves as a lighting device to light the lamp **14**. The control unit **23** controls the ballast **19**. The storage battery **26** supply power to the ballast **19** and the control unit **23**. The light projection opening **12** of the case **13** is covered by a protection plate **20** with transmittance that is made of glass or resin. The light projection unit **21** is constructed to include the case and the optical system **18**, and projects a light **22** having a peak brightness equal to or larger than 30000 cd. The color of the light **22** can be changed by the filter **17**, and can be white or a color adding a background color.

The ballast **19** is controlled by the control unit **23**, and the control unit **23** is capable of controlling a light output, including turning on and off the lamp **14**, according to the environment conditions, such as snowfall, rainfall, fog and traffic, etc. For example, when the detecting device **24** detects a snowfall amount (or a rainfall amount and a fog density, etc.), the lamp **14** is usually turned on with a rated output when the snowfall amount exceeds a predetermined amount. The control units **23** can control the lamp **14** to reduce its light output when the snowfall amount decreases. This control scheme can be executed by a program set in previously conducted experiments. In addition, for example, according to time information from the timer **25**, the lamp **14** is usually lit from the evening to the midnight, and the lamp **14** is controlled according to the traffic volume and the time zone in a manner that the light output of the lamp **14** is reduced from the midnight to the morning when the traffic of cars, etc. is small. Furthermore, the detecting device **24** used in the environment detection can utilize an environment transmissometer. The laser beam is irradiated from the light projection unit **21** to the receiver, and the surrounding environment status, such as the snowfall amount, the rainfall amount and the fog density, etc. can be found from a ratio of the light amount reaching the receiver.

The detecting device **24** can be also in connection with the wind driven generator **60** and the solar generator **34** to detect the surrounding environment. In this way, when the weather condition is detected to be suitable for generating the solar power, the electrical power generated by the solar generator **64** is stored in a storage battery. In addition, when wind is detected by the wind driven during the snowfall, a stormy weather such as snowstorm, and the lamp **14** of the light projection unit **21** is lit by the electrical power generated by the wind driven generator **60**. The projected light irradiates the snowfall during snowing, and the rainfall during the rain, and the fog, etc., and the snow, the rain and the fog glisten, which can be visualized as a light pillar from the light projection unit **21** to the pavement of the road **27**. Therefore, the driver driving the car A on the road **27** can easily identify

the boundary between the road **27** and the shoulder **29** by the light pillars **22** of the light **22** formed with a predetermined distance along the road **27**, while confirming the route of the road **27**.

In the night other than the bad weather, even though the lamp **14** of the light projection unit **11** is adjustably lit, the visibility of the arrow sign **40** is still good, and the driver who driving the car A on the road **27** can confirm the boundary between the road **27** and the shoulder **29** by the arrow signs **40** formed with a predetermined distance along the road **27**, while confirming the route of the road **27**. Therefore, the lamp **14** can be adjustably lit by only the electrical power stored in the storage battery **26**.

While the present invention has been described with a preferred embodiment, this description is not intended to limit our invention. Various modifications of the embodiment will be apparent to those skilled in the art. It is therefore contemplated that the appended claims will cover any such modifications or embodiments as fall within the true scope of the invention.

What is claimed is:

1. A road indication device, comprising:

a light projection unit, arranged above a boundary of a carrigeway, for projecting a light towards the carrigeway, wherein a peak luminosity of the light is equal to or larger than 30000 cd; and

a light guiding device, installed outside of the light projection unit and arranged at a light projection side of the light projection unit to be visible to a driver, and comprising a light pipe, a light guide and an optical fiber.

2. The road indication device of claim **1**, further comprising an arrow sign whose backside is formed on the light projection unit so that the arrow sign is directed to the boundary of the carrigeway.

3. A road indication device, comprising:

a light projection unit, arranged above a boundary of a carrigeway, for projecting a light towards the carrigeway, wherein a peak luminosity of the light is equal to or larger than 30000 cd; and

a reflection member, installed outside of the light projection unit and arranged at a light projection side of the light projection unit, and comprising an arrow sign that includes a reflection portion bended from edges of an arrow portion at a lower end of the arrow sign to a surface where the light is irradiated there to, while a reflection light reflected by the reflection portion is irradiated to a surface of the arrow sign.

4. The road indication device of claim **3**, further comprising an arrow sign formed on the light projection unit, the arrow sign having a surface coated with a reflection material and illuminated by the light projection unit.

5. A road indication device, comprising:

a light projection unit, arranged above a boundary of a carrigeway, for projecting a light towards the carrigeway; and

a light control member arranged between the light projection unit and the carrigeway to prevent the light irradiated from the light projection unit towards the road paving from reaching the carrigeway.

6. The road indication device of claim **5**, wherein a surface of the light control member facing the light projection unit is formed by a mirror surface for reflecting the light.

7. The road indication device of claim **6**, wherein the light control member is constructed in a manner that the angle of the light control member with respect to the light from the light projection unit is changeable such that the light reflected by the light control member is irradiated parallel to the road or along a crossing direction of the road.

8. The road indication device of claim **5**, wherein the light control member is installed at a height equal to or larger than 1.5 m from the carrigeway.

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